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What Modern Equipment Has Done

One of a series of articles giving the actual results achieved by replacing obsolete with up-to-date equipment

Shop No. 7

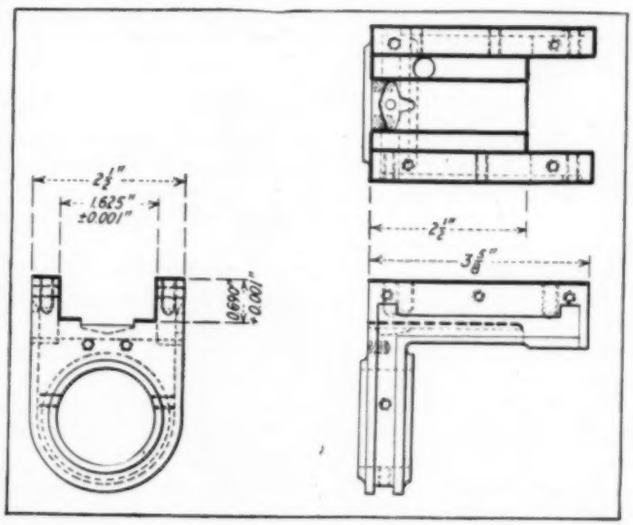
The Landis Machine Company

St. Louis, Missouri

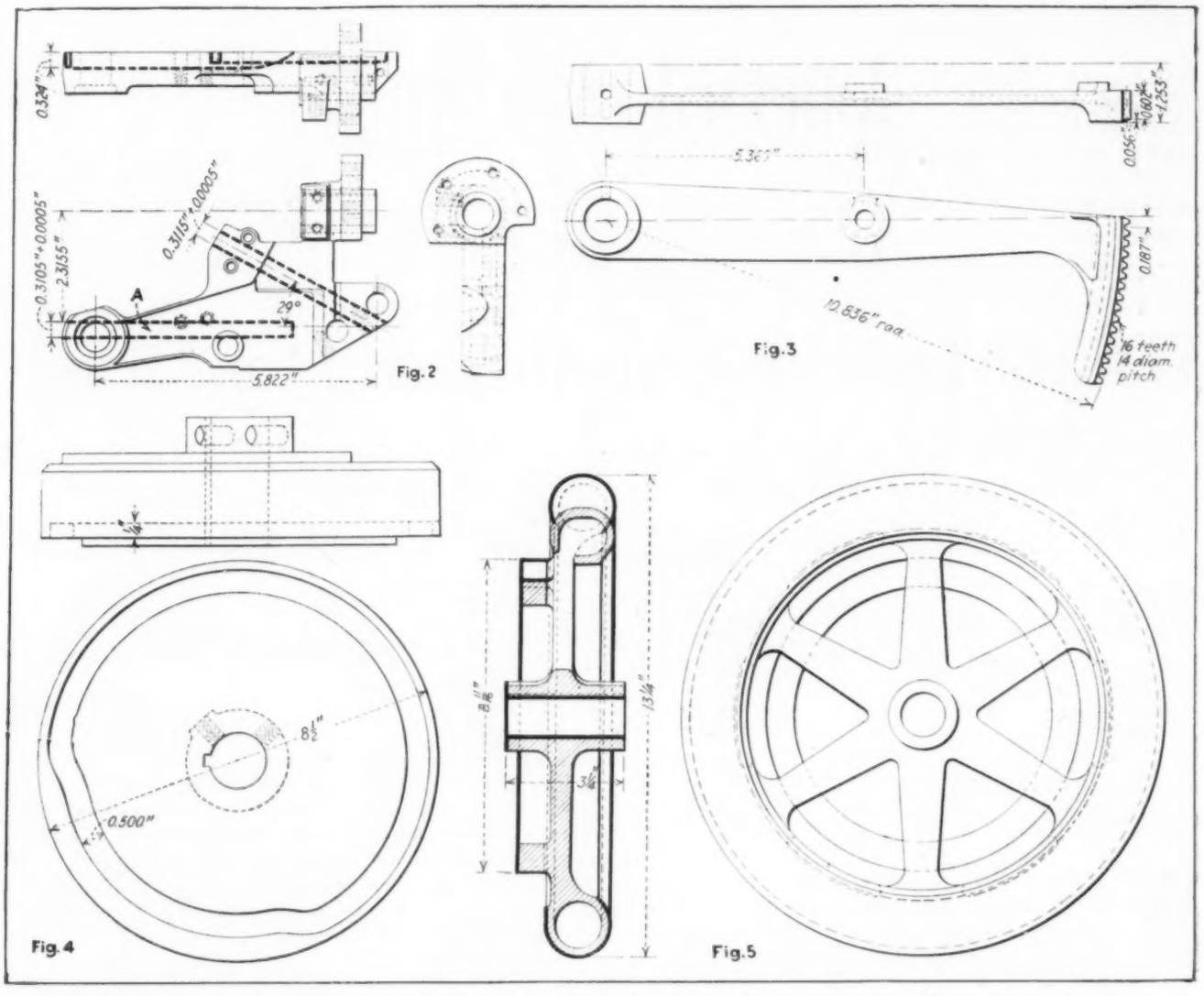
By Ernest Dunford
Works Manager

With our product, which consists of a line of shoe-repairing and rebuilding machinery, the output comes under the classification of semi-production manufacturing. In most cases, parts are turned out in lots of 1,000 units at a time, as a normal basis for a month's requirement. Orders for units will vary slightly on some of the smaller or the larger components, but our aim is to adhere to this amount whenever possible, because it has enabled us to establish a satisfactory cost system as well as to receive the advantages of certain economic production methods. Therefore, our machinery as a whole must be flexible enough to handle different types of parts, inasmuch as the operations are handled in such a way that an order of 1,000 pieces is completed in a relatively short time. In consequence of this condition, single-purpose machines find little use in our plant. Accuracy and interchangeability in manufacture are most essential. First of all, precision methods aid in reducing our assembly costs, since properly machined parts can be fitted together easily. Then, an additional benefit is that whatever spare parts are ordered can be shipped with the knowledge that they will fit. Our machines are sold on a guaranty basis—service free for one year—therefore, if they are made uniformly and accurately, our service duties are naturally minimized. On this basis, the importance of modern producing equipment is easily visualized. Several examples of cost reductions made possible by such equipment are listed.

By routing the milling of the top face of the clutch expansion body shown in Fig. 1, in a duplex-type machine, the operation is completed in 1½ min., as compared to a former time of 3 min. per piece when it was handled in a plain-type machine. The change necessitated the construction of an additional milling fixture to accommodate two pieces, one of which is being machined while the other is being loaded. In this case a production increase of 100 per cent was attained. Another example of a saving in milling is afforded by the head, illustrated in Fig. 2, which is of drop-forged steel. The slot *A* is finished in one cut in 1¼ min. The size and the depth of the slot are held accurately, whereas the location is equally as important. As formerly handled in a lighter machine, the slot required a roughing and a finishing cut, consuming 2 min. for completion. The time saved is small due to the required reduction in



1 *By milling the top faces of clutch expansion bodies in a duplex-type machine, in place of the plain miller heretofore used, the time per piece has been reduced from 3 to 1½ min. An additional milling fixture was required to carry out the new set up, which in turn has resulted in a 100-per cent increase in production*



2 *A production increase of 14 per cent has been attained by using a heavier-type milling machine to cut an accurate slot in the drop-forged head*
3 *A heavier-type machine, using a multiple-type cutter for the teeth on this part, increased the production 270 per cent*
4 *By the former method, five cuts were required for milling the cam races in the thread hook. With heavier equipment only two cuts are required, or a production increase of 75 per cent*
5 *By turning, facing, boring and reaming, this cast-iron handwheel in an automatic turret lathe, the time per piece has been reduced from 18 to 10 min., an increase of 80 per cent*

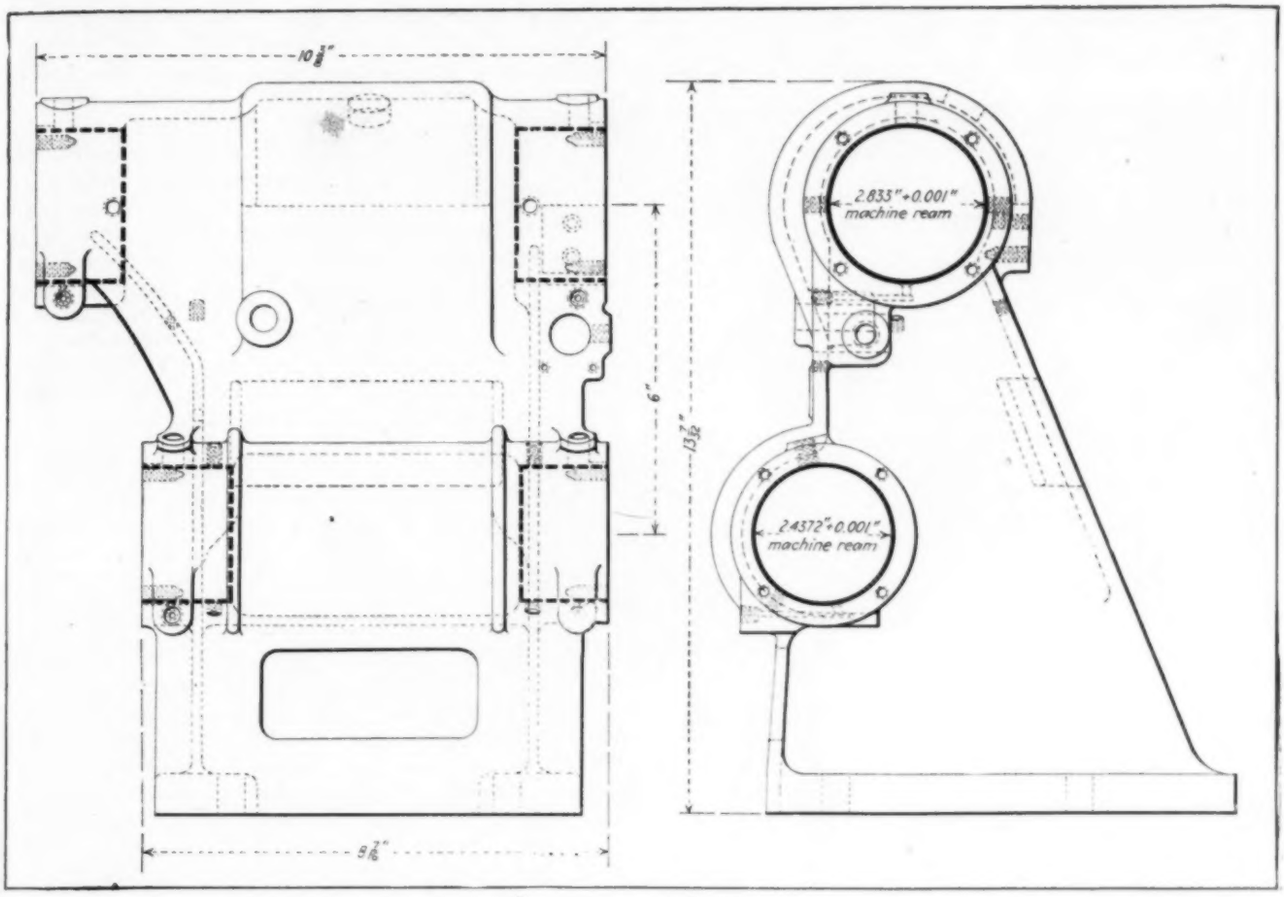
speed and feed, but the class of finish attained is far better. Contrary to the usual run of milling, the cutter is operated downward, which of course, requires a rigid machine in order to avoid having the teeth dig into the work. An increase of 14 per cent was the result of the change. The angular slot, also indicated in the illustration, is machined in a similar way in the same machine.

The drop-forged cam lever, shown in Fig. 3, has 16 teeth machined at its outer end, which were formerly rough- and finish-cut one at a time in a light manufacturing-type milling machine. The operation required 45 min. per piece. By transferring the job to a heavier-type machine and using a multiple-type cutter, enabling all teeth to be cut at one pass, the rough- and finish-cuts require but 12 min., a saving of 33 min., which is equivalent to a production increase of 270 per cent. The changed method has necessitated the construction of a new fixture.

Cam races in the cast-iron thread hook, illustrated in Fig. 4, are cut in 4 min. each, using a heavy-type machine and a two-lip end mill. Two cuts are taken, the first leaving 0.01 in. of metal to be removed at the finish. The cams are cut from the solid, $\frac{1}{4}$ in. in depth, and $\frac{1}{2}$ in. in width. When the operation was handled in a lighter machine, using different style cutters, a total of five cuts were required, consuming 7 min. for each end, to complete a piece. On this basis the production increase is 75 per cent.

An example of a job performed in an automatic turret lathe is the cast-iron handwheel, shown in Fig. 5, which now is machined in 10 min., as against 18 min. by a former method. The operation includes turning the outside diameter and the hub, facing the hub and rim, and boring and reaming the hole. The time reduction is due to the use of a heavy machine enabling the application of heavier feeds and faster speeds. In both cases the operator ran two machines, and the increase in production of 80 per cent, based on the time per machine, is therefore, justifiable.

Perhaps one of the most important units of the trimmer is the cast-iron frame, shown in Fig. 6, which necessitates various forms of machining for completion. The two large holes are of extreme importance, and heretofore were finished one at a time at the rate of two pieces per

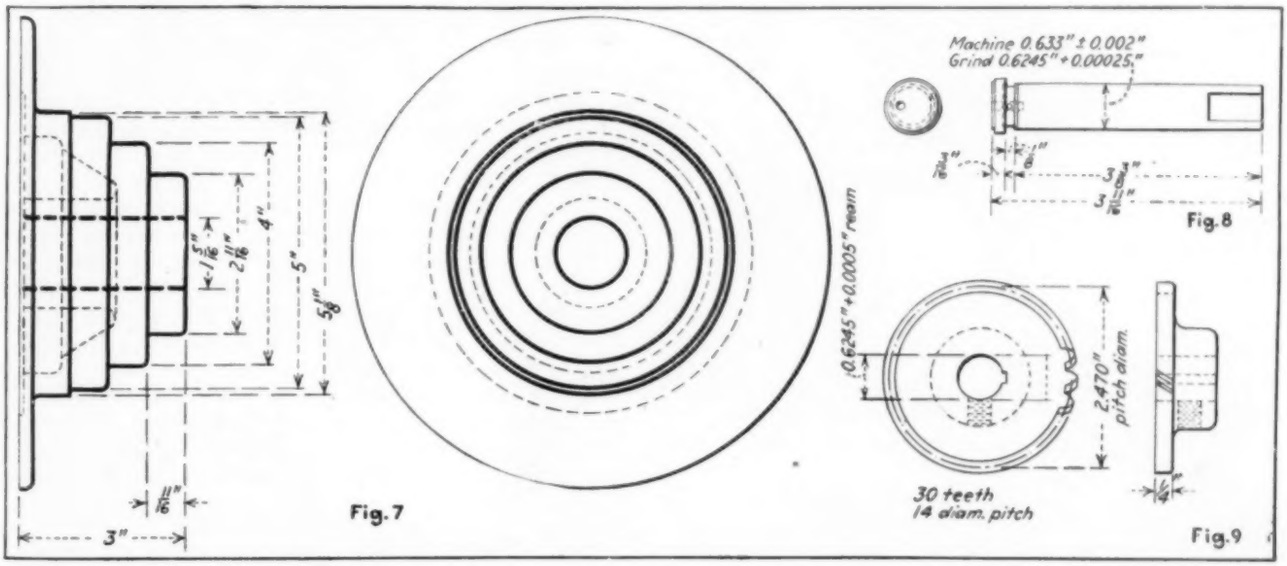


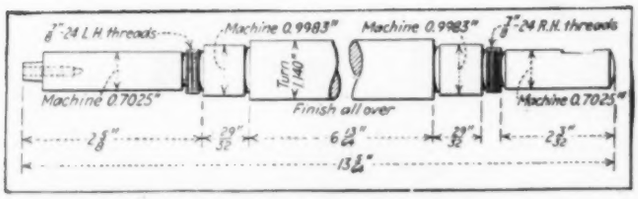
6 *When the two large holes of the cast-iron frame were handled individually, the production attained was two pieces per hour. Since the installation of a larger type of machine, equipped with a multiple head making possible the drilling and reaming of both holes at one setting, the production has been increased to three pieces*

7 *Another example of the cost reduction made in an automatic turret lathe is the power-belt wheel on which a 50 per cent increase in production has been made by cutting the time per part from 18 to 12 minutes*

8 *Centerless grinding has made possible a saving in grinding these studs. The present output is 40 pieces per hour as compared to the former production of 22 pieces per hour, or an increase in output of 82 per cent*

9 *The teeth on the shuttle drive gear were formerly cut on a milling machine, equipped with a dividing head, in 30 min. They are now cut on a gear hobber in 12 min., an increase of 150 per cent in production*





10 *Trimmer shafts are completed in two settings, for one end nine operations are required, and for the opposite end seven. Through the use of a turret lathe of a size permitting heavier feeds and speeds, the time has been reduced from 36 to 26 min. The production increase is 36 per cent*

hour. By installing a larger type of drill press equipped with a multiple head, and constructing a duplex fixture to suit, both holes are done at one setting, with the result that three pieces per hour is the present output. On this basis, an increase of 50 per cent in production is attained.

An example of a cost reduction made under conditions similar to those for the part shown by Fig. 5, is afforded in the finishing of one end of the cast-iron power-belt wheel shown in Fig. 7. This wheel is machined in an automatic turret lathe in 12 min., as against the former time of 18 min. The change has increased production 50 per cent. The back face of the wheel is finished in a lathe, using a mandrel for driving and support.

Centerless grinding the body of the pivot stud shown in Fig. 8, which is made of machine steel and pack hardened, is done in three passes at the rate of 40 pieces per hour. As formerly handled, in two operations on a cylindrical machine, the production was 22 pieces per hour. The increase in production was 82 per cent.

Before purchasing a hobbing machine for the cutting of gears, this class of work was handled in a milling machine, using a dividing head for indexing. Such an example is shown in the cold-rolled steel shuttle drive gear, Fig. 9, made with spiral teeth, which formerly required 30 min. for completion. The job was handled by cutting two pieces at a time. By the present method of hobbing, also handling two pieces at once, the time per piece has been reduced to 12 min., which is equivalent to a direct production increase of 150 per cent.

A turret lathe job that has created an increase in production of 38 per cent is the trimmer shaft illustrated in Fig. 10, which is handled in two settings. At one end of the shaft nine operations are performed, while at the opposite end only seven are required. The part is made of an alloy shaft steel, having its outer diameters ground after being heat-treated. A quantity is finished in the turret lathe at one end first, then the tooling is changed to suit the machining of the opposite end. The former method required 36 min. per piece for completion, whereas the present time is 26 min. for both ends.

Centerless grinding has made possible production increases for several parts. One of these is the stud of Fig. 8. The other is a stud ½ in. in diam. and 3⅛ in. in length, which is made of cold-rolled steel and pack hardened. As formerly made, the operations included the centering of both ends, and rough and finish grinding on a cylindrical-type machine. By this method the grinding production was 25 pieces per hour. Since changing the job to the centerless, the production has been stepped up to 80 pieces per hour, requiring five passes and removing the same amount of stock, namely 0.015 in. The production increase in this case is 220 per cent.

For all the examples shown, the time per piece is figured with an allowance for set-up time, which is distributed, of course, over a quantity of 1,000 pieces. The figures are conservative, and in some cases can be bettered, but they represent actual experience over a period of six months or more. The average production increase for the eleven examples is slightly more than 102 per cent, showing that modern equipment was worth while.

Consulting Engineering As a Profession

By J. J. Provost

I HAVE received many inquiries from consulting engineers anxious to know what methods I have found most effective for acquiring clients and work. Many write that they believe the field is already overcrowded, but, in my opinion, the consulting engineering field in mechanical lines is broad enough and so little developed that there is room for an unlimited number of men to build up good businesses in specialized lines.

Very often the consulting engineer tries to cover too wide a field, and in so doing misses the essential for attaining a growing business. Others depend on the recommendations of friends or relatives, or of satisfied clients, to build up a satisfactory business. Still others use salesmen or some form of direct representation, while some depend on advertising alone. All of these methods have some merits. I believe that a well-worded professional card kept before the public in some good trade journal is valuable, but it is also necessary to put in effect other plans to bring in the business when and how it is needed.

We all know that a man who feels in good health dislikes to visit a doctor to be told his health is all right. In like manner, very few firms will go after professional advice before they are compelled to. Moreover, no man likes to be told that his business is sick, and the consulting engineer must not consider that he is the doctor of business. He should compare himself rather to a banker who is approachable for consultation without charge, unless some actual profitable service or product is bought.

Plant inspection should generally come under the head of free service, as well as preliminary investigation of problems submitted. After the engineer knows exactly what profitable service he can render to the prospective clients, he can submit figures on cost of installation and possible earnings. But he should not submit details or drawings until he has received an order. The consulting engineer should inspect all the plants that he possibly can, as well as the products in the line on which he is specializing. He will then find plenty of opportunity for submitting specifications and suggestions. In this way, the engineer is selling a product that will render a certain service, the same as any machinery manufacturer or banker is doing; and on the quality of the consulting engineer's product depends his success in his chosen line.

An oil hole in the right place—and filled—saves nine, and sometimes more, hours of repair work.

Saving Time with Welded Assemblies

Photographs by courtesy of the Westinghouse Electric and Manufacturing Company

Fig. 2 shows a welded gear assembly for a heavy freight elevator. This was a special replacement job, and the features were saving of time and increased strength obtained in the limited space

The special bearing pedestal shown in Fig. 1 was made of standard steel plate arc-welded together in order to save the expense of making an expensive pattern and core box. Incidentally, it cut down the production time considerably. The pedestal weighs approximately 1,200 lb., representing a great saving in weight

The welded floor plate illustrated in Fig. 3 is 15x7½ ft., with 2-in. steel plates on the top. The advantages of the fabricated floor plate are low first cost, ease of adaptation of the same design to varying floor conditions without pattern changes, and lightness that makes it easy to transport it to other locations

Heat-Treating Large and Small Lots With Up-to-Date Equipment

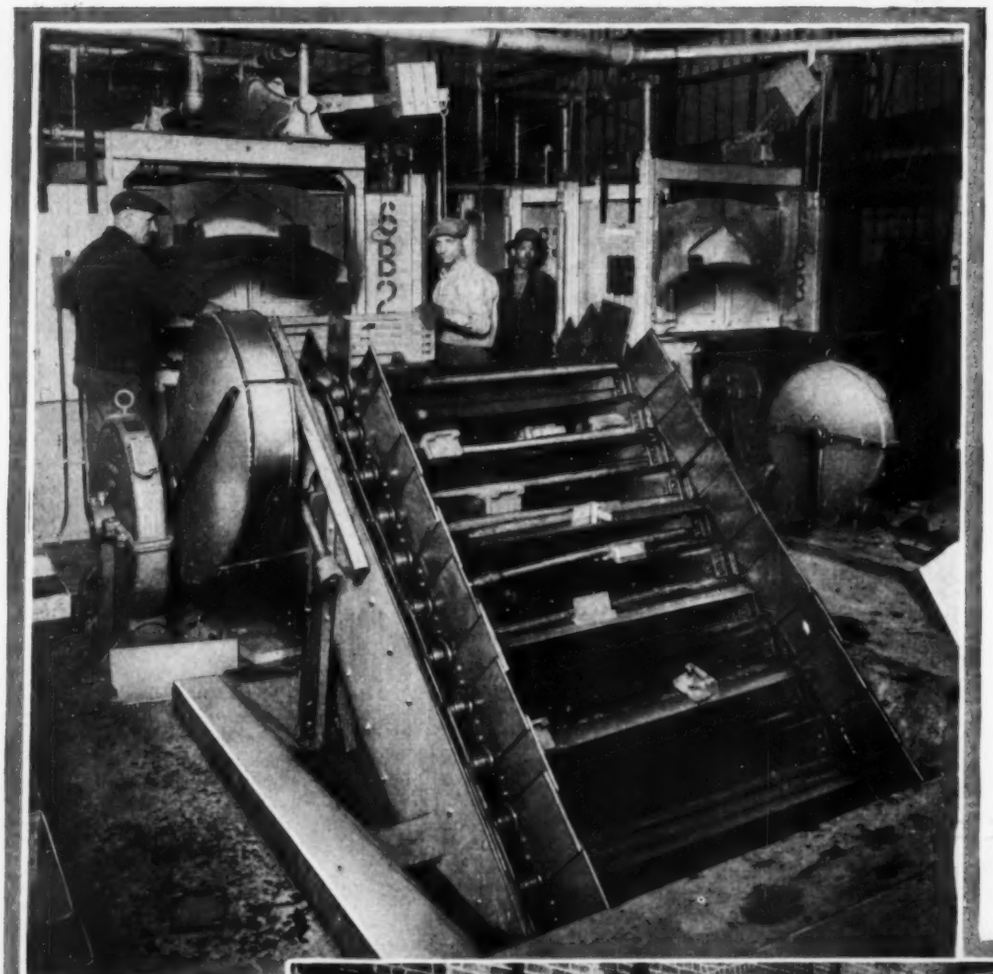


Fig. 1—Inlet-end of drawing furnaces. The work has just gone through the hardening furnace, from which it was automatically discharged into the quenching tank. The conveyor is elevating the hardened work to the charging table, from which it will be charged into the drawing furnace by means of a mechanical pusher. The speed and stroke of the pusher are controlled by a time clock, thus regulating the heating periods. The furnace temperatures are regulated by pyrometric controls

Fig. 2—A battery of indirect-heat, or oven-type furnaces, used in connection with the treating of miscellaneous small parts. It is essential that the products of combustion do not come in direct contact with the metal being treated. The furnaces are applied for preheating, carburizing, and annealing, operating at heats varying from 400 to 1,800 deg. F., and are controlled by pyrometers

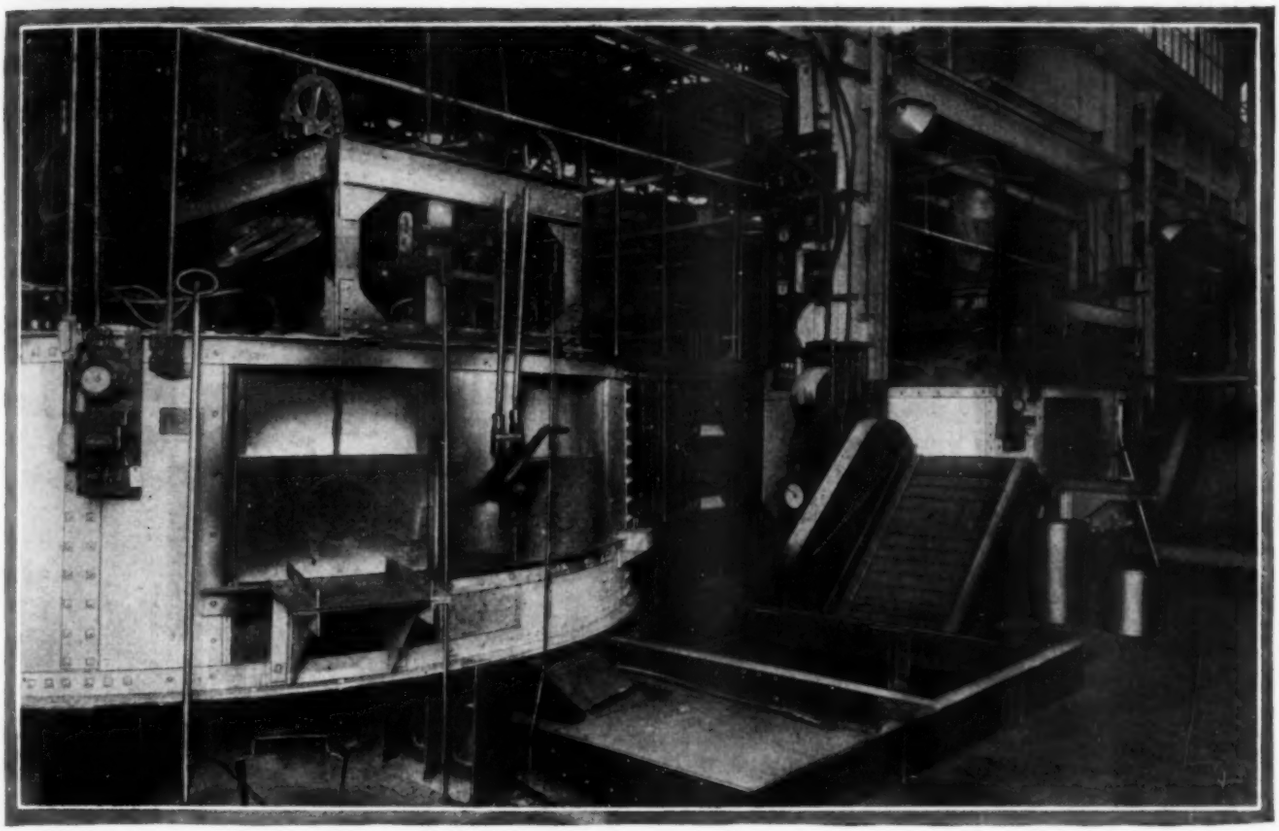


Fig. 3—Continuous rotary-hearth furnaces with automatic discharge. After the proper time interval, the hearth, which consists of a number of trays, rotates a distance equal to the width of one tray, and the tray over the chute is discharged into the quenching tank. One of the furnaces shown is used for hardening and the other for drawing. A conveyor serves each unit

Fig. 4—A four-chamber counterflow regenerative carburizing furnace of the pusher type. Rows of carburizing boxes in alternate chambers are automatically pushed in opposite directions, thus allowing out-going boxes of material to cool beside incoming boxes. This counterflow arrangement saves some of the heat that is ordinarily lost, and results in an increase in furnace economy. Each chamber has a temperature control at two points. An overhead hoist facilitates handling of the boxes

Beware of Stratification

"QUARTER of six, Bill. Are you sure you aren't missing some dinner engagement your wife has made?"

John Lockwood swung abruptly on his chair and confronted his guest. Holland sat thoughtfully in the corner of the quiet office, doubly quiet since the machines had stopped an hour before. Lockwood's company faced an expansion and the men for the new positions seemed hard to find.

"Nope," he remarked briefly. "The Mrs. has gone over to hold a confab over her newest grandchild. He only gained four ounces last week and they're ready to fire the doctor because he didn't do better. Told me I could go to the club for dinner, or anywhere else I chose. I've got another hour, if you're not too tired."

"I'm tired all right, but I've got to reach a decision on this thing or I'll lose what little brains I have left. We've been over six new jobs now and we haven't found a man for any one of them. What's the answer?"

"Well, John, if you put it that way, I think the answer is that your organization is stratified. By which I mean that there doesn't seem to be any good way for a man to advance from one position, where he may have been for years, to a better one. At least you say either that the man can't be spared or else that he's holding the biggest job he can every time I ask if you can't promote one of your own men."

"I know, Bill, but—"

"Wait a minute. Let me get this out of my system. I have an idea that you have let yourself get into the European way of thinking. I was talking to a fellow yesterday who was just back from a trip to a lot of European shops. He told me that the people in industry are pretty rigidly divided into classes, stratified, I call it. Said that the management and the engineers and the workmen were sharply divided and that the workmen particularly had been taught to take pride in the fact that they were workmen and would never be anything else.

"You've seen the result in all the troubles they've had over there since the war. Some things have changed for the better but this old class idea seems to persist. I don't like to say this, John, but is that what's the matter with your outfit?"

"Good Lord, Bill, I hope not."

But John Lockwood looked suddenly older. Evidently the shot had gone home.

"What is there to be done about it?" he asked, at last.

"I don't know, John," answered Holland. "But I'm sure you'll think of a way out now that you sense the situation. I must trot along. See you soon. Good night."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Making the Most of Floor Space

There is a certain impressiveness about expanding floor space capacity, that is hard to resist and easy to follow. This increase is often taken as an index of prosperity, just as individuals register prosperity with a new automobile. The spirit behind it will probably result in spreading out the machinery in the new building just as was done in the old. Usually, some real close application will find a better and more economical use of floor space.

New machines, because of the lack of familiarity with them, are usually given plenty of elbow room as a precaution. Co-operation with the machine manufacturer will establish minimum clearance distances to govern in each case. In this way much otherwise wasted floor space may be utilized. An honest effort to release space occupied by obsolete, or special machines seldom used, will oftentimes help to solve the problem. Maximum use of vertical space for stores, tool room supplies, and materials, will usually discover some additional floor space.

Over-optimistic purchasing of machinery is a sad predicament, but at best there is a market

for it, it is removable, and the loss for the mistake in judgment can be taken once and for all. Not so with floor space. It's there, it costs whether utilized or not, and it can't be moved. To sublet is not always practical nor desirable. Therefore, any expansion of floor space should be approached with a great deal of real thought, and not so much enthusiasm.—EDWARD J. FERGUSON.

The shipping department of a certain plant needed more space in which to move its hand trucks around, without having them run into packed boxes waiting for shipment. Instead of building a new shipping department the management removed the incline leading up to the loading platform, and installed an elevator truck. By doing so 50 square feet of space was added to the shipping department.

Another shop solved the problem of two trucks at each machine by building a single truck, with a partition for separating the finished work from the unfinished. Space for lockers for the shop men can be reduced to a minimum by using the double-tier type. In punch-press departments the use of coiled stock, in place of the long flat strips, also affords a saving of space worth considering.

It may be well to remember that there is probably a new machine designed to produce two or three pieces in the time it takes to turn out only one piece on the old machine. It is obvious that one new machine can displace two or three of the obsolete type and thus take care of increased production in less space. —SAMUEL KAUFFMAN.

Vacations and Bonuses

The method employed by a certain company is founded along the following lines: Every employee is graded in accordance with the amount of time he has been employed in the service of the company, there being five classes. An employee who has served a period of six months to a year is placed in class V, one to two years in class IV, two to four years in class III, four to ten years in class II, and ten years and over in class I. In conjunction with the grading of employees in regards to service, each employee receives a certain percentage rating at the end of the year, based on his average efficiency, covering productive effort, quality of workmanship, punctuality and number of days present in a month.

This efficiency mark is taken from a premium system which was applied quite a number of years ago, in which an additional bonus is paid each month to those reaching an average of 80 per cent or over, the amount being in accordance with the percentage attained. About two weeks before the vacation period, each employee is handed a card on which is shown his service classification, efficiency percentage, and the amount of bonus he is to receive. Therefore, when the factory closes on the Friday night before the vacation period, each employee receives in addition to his regular pay envelope, a pink envelope in which is enclosed his vacation bonus.

This makes it possible for those who have tried to do their work properly during the year, to enjoy their vacation period, without wondering where the money will come from. This system has proved successful over a period of three years. —FRED AUG. SCHMIDT.

How Much Overhead?

Overhead, when considered as a ratio to direct labor, may vary all the way from almost nothing to infinity, as exemplified by a man working at a bench with only a hammer for a tool, as compared with a sub-station of an electric power company which is fully automatic. In the first case, the cost of the product might be reduced by performing the operation on a machine and greatly increasing the overhead, but in the later case any change would increase the cost even though the employment of an attendant would greatly decrease the ratio of overhead to direct labor.

Andrew Carnegie threw out so many old machines that, for a time, he was called "The great American scrapper." He undoubtedly increased the overhead both in actual dollars and as a percentage of direct labor, but at the same time he decreased the cost of the product and made a great success of his enterprises.

In this machine age it would be well to forget the old ratios and look only at the cost of the product, and at the dividends. However, in order to do this it is necessary to have a reliable cost system which is tied up with the general books, and which can be proved.

—C. J. MORRISON.

How Much Shall We "Doll Up" the Plant?

A plant which makes no effort to appear attractive, which has a dirty yard all cluttered up, and which seems to be badly in need of paint and external repairs, suggests a concern which is insecure, and interested only in immediate maximum profits. There may be those who think that this is good business, but I believe the employee feels that he is there merely to get the most he can for the least he can do, in a sort of day-to-day fashion. He feels that such a concern will never give a raise voluntarily, since they are unwiling to spend any money that they are not forced to spend.

Conversely, the well-kept plant, properly painted, with well-kept lawns and a few trees or

shrubs, suggests permanency. It looks as though a job with them will be secure as long as the employee makes good on his work. It suggests a firm that is willing to listen to new ideas for future betterment. Such a concern inspires confidence in its relationship with its employees. It is felt that they will deal with their employees in a conscientious way. A man who is ill will feel that such a concern will permit him to take a day or two off, if necessary to proper recovery.

The "dolling up" process need not be elaborate. A suggestion of cleanliness and care, is much more to be desired than an ornate get-up. The process should, if at all possible, be distributed throughout the entire property, rather than to be confined to the office property, which is sometimes the case. Properly applied, money so spent, is a splendid investment in company spirit. Last but not least, a man's family thinks a lot more of such a concern, and will urge him to stay if he is tempted to leave. —WALTER STEINER.

How Much Interchangeability?

The standardization of a mechanical device to the point that all parts are absolute duplicates, is the goal toward which 99 per cent of all manufacturers are striving, and none have ever reached, except in the case of the very simplest machines.

Proper tooling is the prime essential for interchangeability, and tooling is expensive. Whether it will pay, depends on the product and the volume of sales. The possibility of a change in design, to improve or reduce the cost of a product, stands as an ever present specter which must be gravely considered before going too deep into the expense of jigs and fixtures. Many a concern has spent so much at the beginning to achieve the absolute duplication of parts, that they have had insufficient funds remaining to place their output on the market. Others must of necessity withhold the making of improvements until they realize the return on the tool investment, thereby allowing their competitors to obtain the jump on them with more modern designs.

The small shop with a limited output can obtain a reasonable degree of interchangeability of the less accurate parts by the use of simple jigs. To go further than this in most cases is a foolish expenditure of funds.

To render service on parts that had limits of plus or minus 0.001 in., and whose size was governed by a compounding of four other pieces, as well as the varying thickness of a layer of paint, one company entered these dimensions in their record book together with the serial number of the machine. In machines sold to the same concern, a finishing cut was made on each for a very small addition charge, in order that the device would be usable in every machine sent to the purchaser. There were never any objections raised to this charge. It was easily realized the useless expense, which of course would be passed on to the purchaser, that the matching of all machines would entail. This left the company free to improve their product. At the same time the purchaser knew he would always have available the opportunity of obtaining accurately fitting duplicate parts.

Interchangeability of all parts is excellent and good sales talk, but if it must be achieved at a great increase in unit cost, it is a matter that requires careful study. —JOHN L. SPENCE.

Selecting Shop Executives

When the super wants a foreman, his first impulse is to look over the best workmen and pick one that looks good to him. If the man proves to be a good executive, everything is jake. If he does not there are at least two disappointed men, the man himself and his super. There are a great many of these disappointments. More unfortunate than this is the fact that most of the men who are promoted because they are good workmen continue in the idea that it is being good workmen that keeps their jobs for them.

Knowledge of the work and ability to do it oneself is necessary. Intelligence is necessary. But one may have both in high degree and yet fail most dismally as an executive. Both experience and intelligence should be inquired into, but beside these two things there is a rather intangible something that makes all the difference between an executive and a supervisor. An executive must be able to plan work, and to convey his plan to others in such a way that they are glad to cooperate in putting it across. The judgment to form the plan is a part of intelligence. The ability to convey meaning to others is entirely another matter that is not brought out by experience as a workman nor tested by an intelligence test. It can probably be taught, though where a man could go to learn, I am sure I do not know. The last thing, to tell the plan to others so that they enthuse about putting it across, is salesmanship. Some men are born with it, and some probably do acquire it, though my faith in the schools that claim to teach salesmanship is rather dim. Enough to say, that like other forms of salesmanship the successful man must have entire faith in what he is trying to sell. Sometimes, I wonder if that is not the whole secret of success. I am sure that a great many unintelligent men make good salesmen, and that they sell things in which an intelligent man could not have faith. This may be one reason that good engineers seldom make good salesmen.

For foreman, then, I nominate a man of experience, and intelligence, who can plan work and enthuse over his own plan. No doubting Thomases wanted. —ENTROPY.

Next Week

Pricing Repair Parts

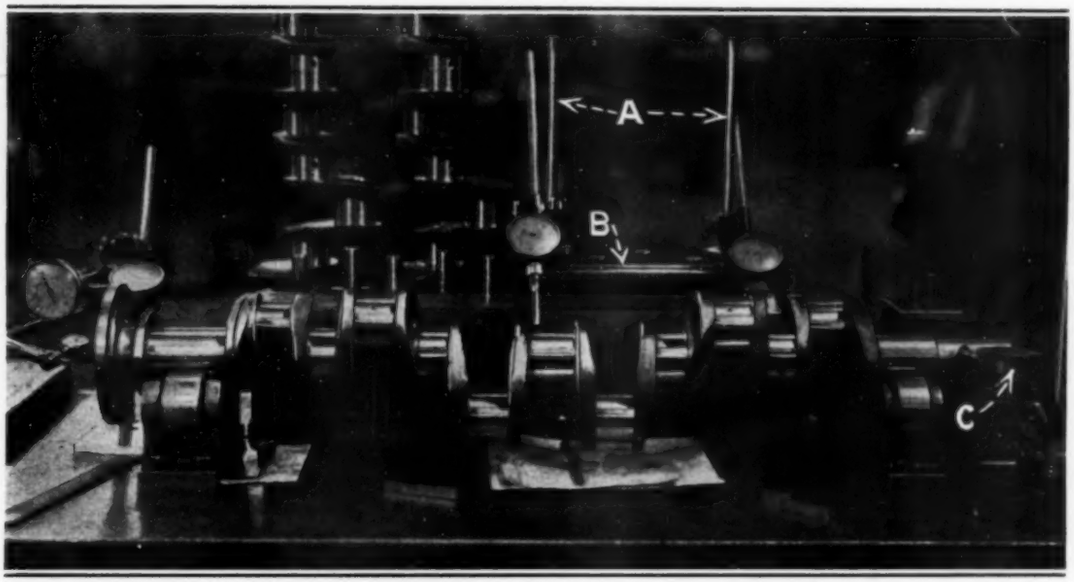


Fig. 125—Fixture for inspecting crankshafts at the Chrysler plant

Inspection Methods and Their Application

By Fred H. Colvin
Editor, American Machinist

Crankshaft inspection in several automobile plants—While the gaging fixtures in some of the plants are similar, in others they differ considerably

THERE are so many points to be inspected on the modern crankshaft that gage designers have had great opportunity to evolve ingenious instruments. A Chrysler device is shown in Fig. 125, in which the shaft is mounted by the end bearings on rollers. The roller standards locate the shaft endwise, and sliding gage blocks operated by handles *A* test the location of each crankpin and main bearings as the shaft is revolved. Beginning at the left, the small dial gage in line with the center of the shaft and the two larger gages, check the concentricity of the recess shoulder, the face of the flange and the flange run-out, respectively.

For checking the roundness of the main bearing, the block *B* carries two dial gages spaced two bearings apart. Moving this block along the top of the fixture enables the inspector to test every bearing. The dial gage at *C* checks the front end of the shaft and the various gage blocks on the base of the fixture test the lengths of pins and bearings, as well as the fillets. Needless to say the rollers on which the shaft revolves must not only be very round but must also be accurately mounted.

The tests for both static and running balance are illustrated in Figs. 126 and 127. In Fig. 127, the knife edge is used in place of rollers. Running or dynamic balance is checked on the Gisholt machine, in which the chart is conveniently located near the unbalance indicator.

In addition to the usual gages for checking diameters of bearings, squareness of flanges and other details, the Continental plant employs the slide gaging fixture illustrated in Fig. 128 to insure the proper spacing of bearings as they come off the roughing lathe. While there is nothing unusual in this fixture, it is easily made and is convenient to use. The shaft rests on its end bearings. The right-hand slide checks the position and contour of the oil-slinging flange. This type of slide gage can also be used to check the diameter of the bearings, if desired, either by graduations or by the flush-pin method. This gage is quite universal as it can be converted to gage any crankshaft by relocating the sliding members.

Before testing for size and accuracy, the Graham-Paige plant makes sure that the oil passages in the crankshaft are clear. These passages are blown out by air pressure in the tank shown in Fig. 129. The shaft is placed in the tank and fastened in position below the surface of the water. Air is then blown through the various oil passages, and the air bubbles show whether they are clogged in any way. A rather unusual test for the oil pipe lines that go in the crankcase is made in this plant. Instead of depending on pressure a steel ball is rolled through each branch of the pipe, proving beyond a doubt that the passages are clear.

The spacing of both the main and crankpin bearings is

Conclusion of the eighth article. The ninth will appear in an early issue.

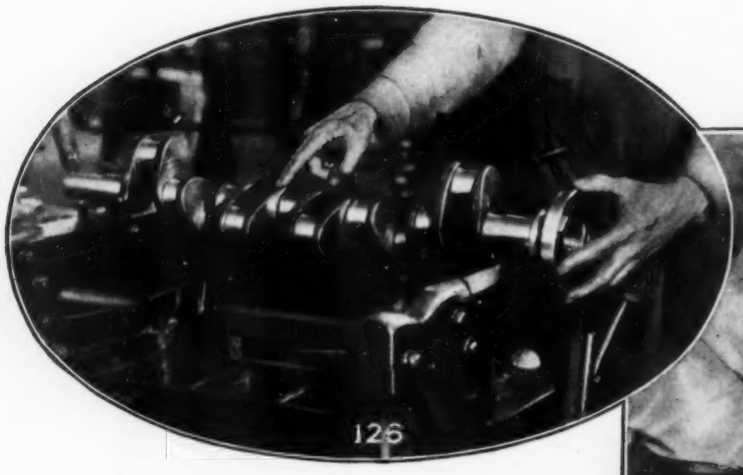


Fig. 126—Testing static balance on knife-edged balancing ways. From this machine the crankshafts are taken to the machine in Fig. 127 in which the dynamic balance is tested

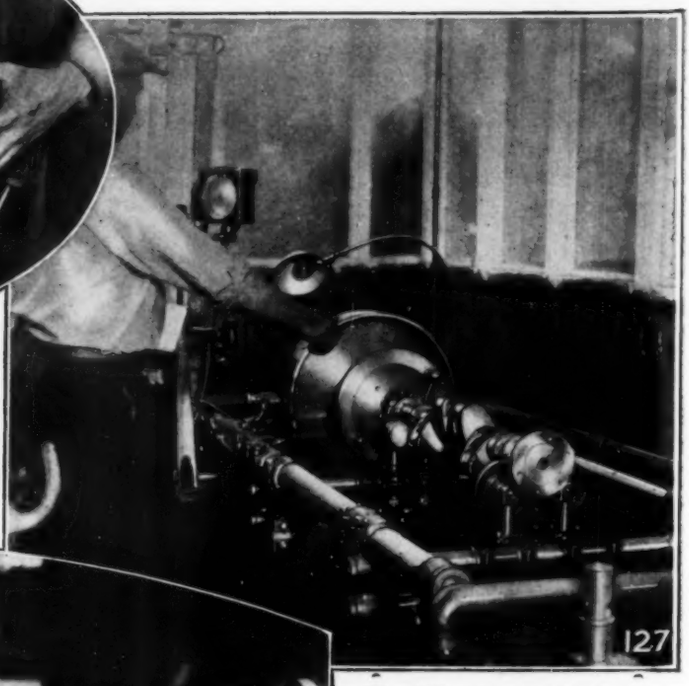


Fig. 127—The final balancing test of the crankshaft is made on this machine. The shaft is driven from the left end and the indicator and charts show how much metal must be removed and from where

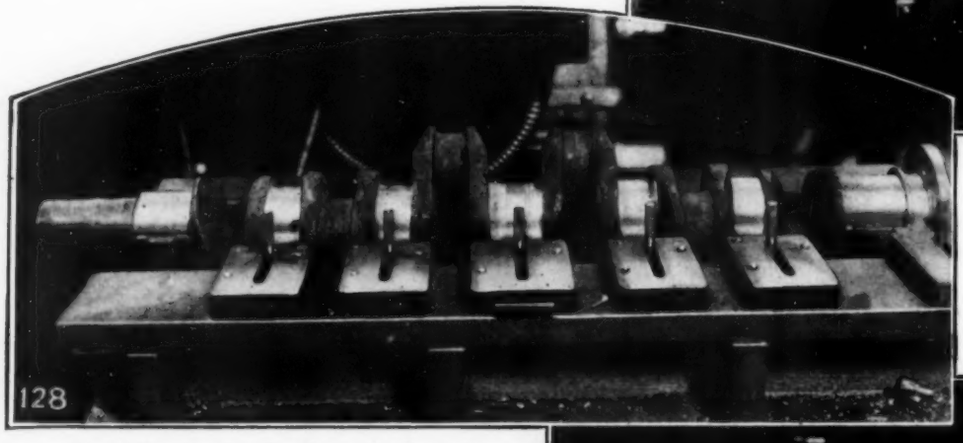


Fig. 128—In the Continental plant the spacing of the main bearing is checked after rough turning

Fig. 129—Cleaning out oil passages between bearings in the Graham-Paige plant and inspecting them

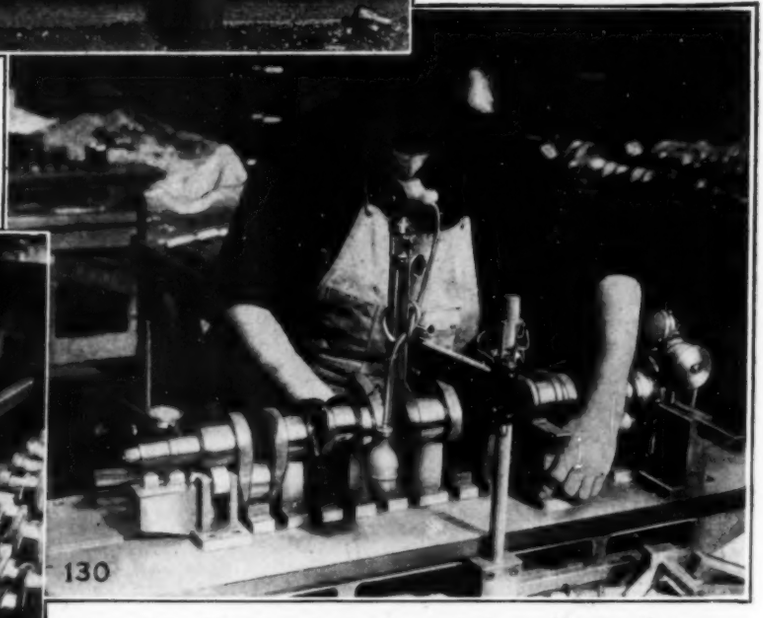


Fig. 130—Checking the hardness of the various bearings and also the spacing of the crankpins and main bearings. A gage block is used to check the angles of the throws

Fig. 131—Checking the balance of the crankshaft. The shaft is rotated by a belt and, after being set in motion, the belt is removed to let the shaft spin freely. The indicators below show any vibration. The vibrating arms can be clamped rigidly by spreading the clamps with the cams shown at the top

checked by the fixture shown in Fig. 130. The shaft is mounted on rollers at each end so that it can be easily revolved. The dial indicators check the roundness of the end bearings and of the flange. The angle of the crank throws can be checked by a gage block as, when two crankpins are at the lowest position, the others are up so that the block can slide under them. The hardness can be checked by the scleroscope to be seen in the center. In Fig. 131 is the stand for testing both static and running balance.

For static balance the shaft turns freely on the ball-bearing rollers shown at the ends. For testing dynamic balance the shaft is set in rotation by a belt on the second bearing and, after it has attained speed, the belt is removed so as to let it spin freely. The end rollers are supported on flexible arms that can vibrate if the shaft is out of balance. The amount of vibration is measured by the dial indicators near the floor. When it is desired to hold the vibrator arms rigid, for testing static balance, clamping arms near the top are closed on the arms by spreading the outer ends by cams.

The testing fixture used in the Hupp plant, Fig. 132, is somewhat different from those shown previously although it contains some of the same features, such as the roller supports. Narrow rollers are used, however, instead of the wide ones shown in Fig. 131. Details can perhaps be seen to better advantage in Fig. 133, where the crankshaft has been removed to show the gaging points more clearly.

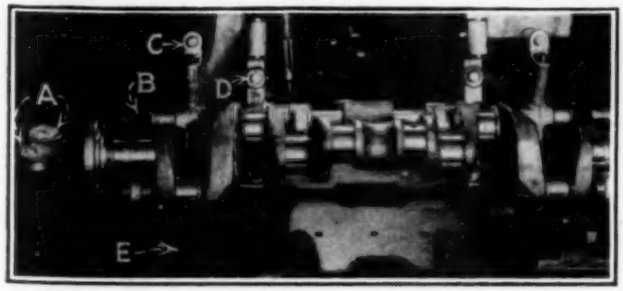


Fig. 132—Fixture used in the Hupp plant for checking various dimensions of crankshafts. Both dial gages and multiplying lever indicators are used. The arms fitted with steel plugs help in checking the angularity of the crank throws

Beginning at the left, Fig. 132, the dial indicators *A* test the face and recess, respectively, in the flange on the rear end of the shaft. The multiplying gage *B* and the other three along the line, test the four main bearings

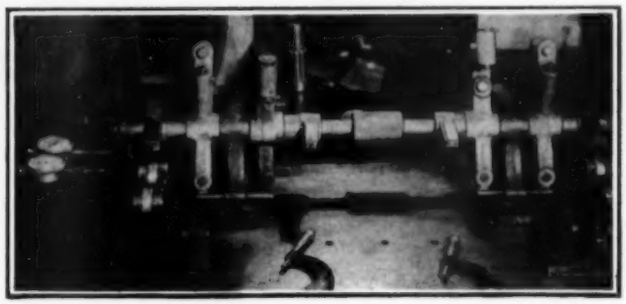


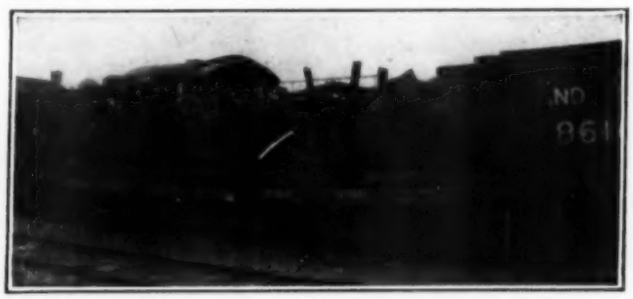
Fig. 133—The same fixture without the crankshaft so as to show the rollers, gages and gaging arms. The gages are turned down in position by the knurled hand grip in the center of the shaft

between the crank throws. Gages *C* and *D* and the corresponding gages at the other end, check the angularity of the crank throws. These gages are swung down into position by means of the knurled hand grip in the center. With these gages down on the crankpins and the latch, or swinging gage, *E* against the pins, the crank throws are in position to be checked. Micrometers also are used for measuring the diameters.

A Locomotive Ready to be Junked

By Frank C. Hudson

IN SPITE of arguments to the contrary, the railroads are scrapping their old locomotives. The illustration shows the way in which a locomotive that has been condemned to the scrap pile is disassembled and loaded on a



A scrapped locomotive ready to be sold for old metal

flat car at the Moncton, N. B., shops of the Canadian National Railway. Everything that is to be scrapped is loaded on the flat car, which prevents having unsightly piles of scrap strewn around the yards awaiting shipment, and makes it easy to ship the scrap to any desired point.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Asking a Man to Come Back

"I HEAR you had a row with Frank Walters this morning, Ed. One of the boys told me you bawled him out in great shape."

"Yes, I did, Al. I fired him on the spot and I'm in a sort of a jam about it, too."

"What's it all about, Ed?"

"Well, I went off half cocked I guess, Al. A piece of work went wrong and I thought it was his fault. He was a bit uppish when I jumped him about it, my temper slopped over and I fired him."

"And it wasn't his fault after all, Ed?"

"No, Al. That's where the jam comes in. I don't just know what to do about it. Frank is a good worker and I hate to lose him. Besides I know he needs the job. But if I go and tell him he can come back the other men will think I'm weak-kneed and don't know my own mind. It's sure to affect discipline in my department. What shall I do about it?"

"It looks as if we'd have to admit we were hasty and in the wrong, Ed."

"But what about discipline, Al, and the effect on the other men?"

"I don't believe that is serious. That is, I don't believe you'll lose any respect by reversing your action. I believe you'll gain a lot more than you lose. The boys will think you're a square shooter. And I don't believe you can afford to let Frank go without at least offering him his job back, and telling him that you were in the wrong."

"Gosh, Al, that's a sort of tough proposition."

"I know it, Ed. But you'll feel a lot better after you do it and you'll stand better with the boys. Williams will be sure to hear of it sooner or later, and he'll think a lot more of you if you face the music and ask Frank to come back."

"I don't just know how to go about it, Al."

"Well, it isn't easy, Ed. But it's the best in the long run. You're not only playing fair with Frank but you are saving the company the cost of breaking in a new man, and you're keeping a good man for them."

"But won't Frank be sore at me for a long time?"

"I don't think so, Ed. He'll know it was a hard thing for you to do, and respect you for it. The chances are he'll be one of your best friends after this blows over."

Was Al right in advising Ed to reverse his hasty action and hire Frank again? Or should Ed have stuck to his decision? How would this affect the men's feelings toward Ed?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Equipment and the Foreman's Reputation

ED HAS the right slant on Bill's duty to his employer. If the boss thought it advisable to continue work with the old equipment after Bill had presented the facts as he saw them, then it was up to Bill to do his best to turn out the work as required. The boss does not expect the foreman to do impossible feats, but to co-operate in getting the most out of materials and equipment at hand. No doubt the boss had very good reasons for not complying with Bill's suggestion. With the latest and best equipment available it would not be a big task to turn out the work. The real test lies in Bill's having to draw on his skill and native ingenuity to get satisfactory results.

When interviewing a prospective employer, Bill will no doubt feel that his reasons for quitting an otherwise satisfactory job seem a little "lame."

—A. TOMLINSON.

Reading the Shop Language

IT IS, of course, to every individual's advantage to know as much about his job as possible. The ability to read blueprints is surely one of those advantages. It should be encouraged and fostered in every possible way, but to insist that it is a requirement for holding a job, is too severe.

Everyone must make a start sometime. The young man who has not previously had experience in reading prints, should not be debarred because of it. The older operator, who has never been encouraged to develop, should first be given his opportunity.

Blueprint reading ability is highly desirable, but not always essential. It should be encouraged, rather than insisted upon. The men worthwhile, will be quick to see the advantage. The others won't count, and will naturally restrict themselves to jobs where it doesn't matter, or else eliminate themselves from the organization. —A. A. CROWELL.

THE success of the plan depends a good deal on the foreman. If he is instructive and shows a willingness to explain all details to the employees, they will always ask him about the drawing when they happen to have any doubts. On the other hand, if the foreman is impatient, and chides the men for not knowing when they ask about things, they will guess rather than ask questions. If they guess wrong, the firm loses.

A compulsory course in the reading of drawings would benefit both employer and employee. It would save the firm many a job that would otherwise have been scrapped, would stimulate interest in the employees, and start many a man on the road to advancement. But it would not entirely settle the blueprint question.

—W. J. OWENS

THE · NEXT · TOPIC

Capitalizing Criticism

ADVANCE QUESTION

A neighboring company permits its foremen to get together and criticise all departments. Al likes the idea, but Ed thinks it is dangerous. What do you think?

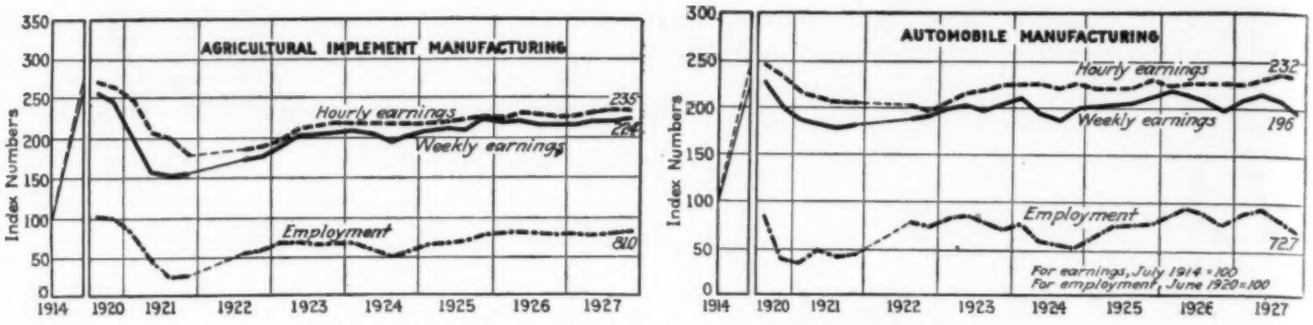
Wear Goggles or Quit

THE wearing of goggles should be rigidly enforced, as there are financial risks on both sides. The workman risks losing his salary, and perhaps his job. The employer is open to the risk of having to pay compensation. If an accident occurs on account of an employee's disregard of rules, the employer is held responsible. It is necessary, therefore, for him to do everything possible to enforce the safety of the workman. The rule can be best enforced by posting suggestive notices showing the risks taken. —T. L. RONALD, *England*.

Hiring in the Open

ALTHOUGH a knowledge of human nature is one of the important requisites of a good employment manager, many of them are so lacking in this quality that they do not seem to realize that prospective employees should not wait hours on a hard wooden bench for an interview, or that, even if their endurance does hold out, these men bring to their work a certain antagonistic attitude which does not make for pleasant relations.

No plant, small or large, can afford to overlook proper and just treatment of the man at the gate. The average man is at a serious disadvantage when being interviewed for a position. Conscious of close inspection, he often fails to pass muster largely through nervousness and inability to present his advantages in the proper light. This nervousness is much intensified when he must present his case to a somewhat callous stranger, in an overcrowded room, with other applicants for the position often within easy hearing. Under such conditions, matters which might vitally influence future relations often go unexplained, as few workers are so indifferent to local gossip as to air personal matters within the hearing of a miscellaneous group. —S. KUPPER.



Index numbers of average hourly and weekly earnings and employment

Trend of General Wages and Wages in the Metal Working Industry

THE importance of wages in general industry has led the National Industrial Conference Board to make extensive investigations in this field, the results of which have just been made public in printed form under the caption "Wages in the United States 1914-1927." Through the co-operation of a large number of manufacturing establishments, building trades and many companies representing various branches of these manufacturing industries, data on wages, employment and hours are collected and published by the Board each month. The present volume is a summation of this data since 1914.

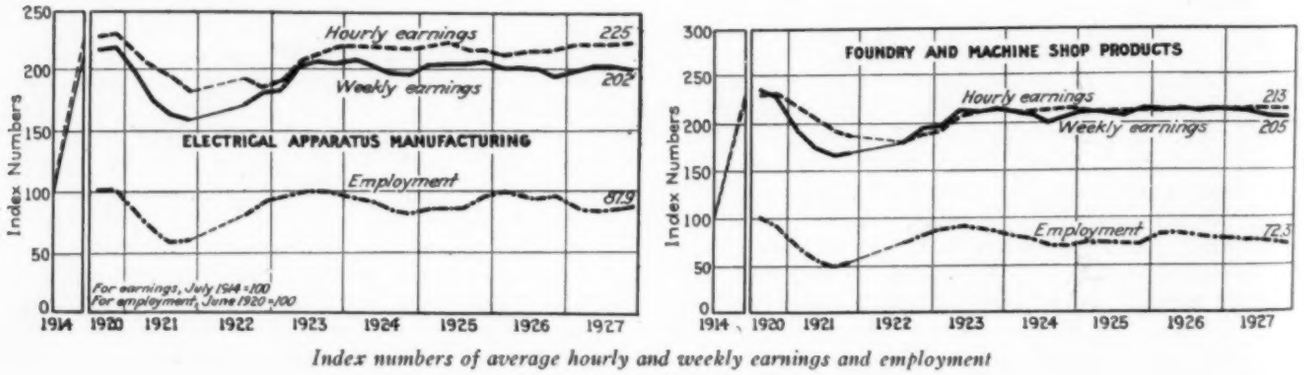
In general there are four phases to the wage question: Wages in their relation to business conditions; wages and prices; wages and the cost of living; and wages and the amount of employment.

The statistical evidence presented in this study makes it clear that during the year 1927 there was a remarkable stability in the compensation paid labor in all fields. Did this stability in wage payment imply a like stability in general business conditions? The Board finds that according to the more conspicuous business indicators the change in the levels of business activity between 1926 and 1927 is nowhere conspicuous. The year 1927 exceeded 1926 in the production of raw materials, in mail order sales, electrical energy consumption by manufacturing plants, and in bank debits, while the value of building contracts was about the same for the two years. On the other hand, the year 1927 fell below 1926 in prices, wholesale trade, unfilled orders and in factory employment. The detail figures show that no general change in business conditions took place during the year, which would make the stability of wages entirely logical. During these two years there was an undoubtedly close relation between wages and business conditions.

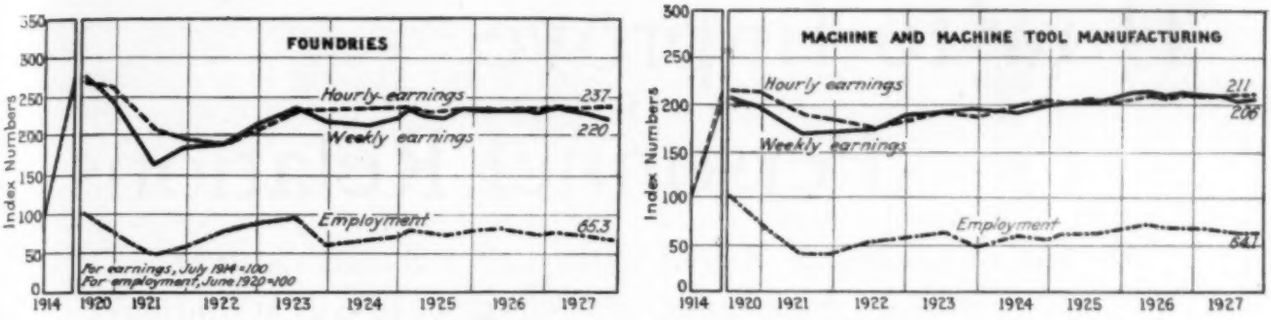
The Board points out that there is, however, a contrast in the mobility of prices and of wages. Just as prices are most sensitive to business changes and reflect every ripple upon the surface, so wages are among the least mobile of the major economic factors, and are among the last to be affected by business changes. Only when such changes are profound do they cause perceptible variations in the remuneration of labor. A general and continued rise in prices, however, is, as a rule, followed at some distant time by a rise in wages. Conversely, a long continued fall may result in a decrease.

The third relationship considered in the report is that between wages and the cost of living. Cost of living is determined very largely by the retail price of commodities. Hence, since men work not for the money they expect to receive but for the commodities they expect to purchase with that money, the varying prices of commodities, shelter and essential conveniences—the cost of living—enter very materially into the question of wages.

The Board is of the opnion, however, that of even greater moment in judging the wage situation is the amount of employment. Whether wage rates change or not, the position of the wage earning group improves as employment increases, and deteriorates as unemployment becomes more and more frequent.



Index numbers of average hourly and weekly earnings and employment



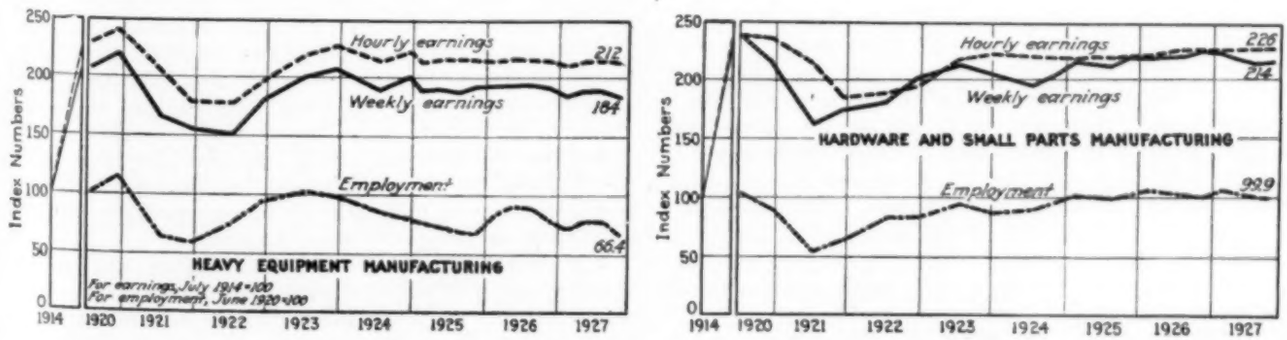
Index numbers of average hourly and weekly earnings and employment

In its tabulation and charts on the past trend of wages in several of the principal branches of the metal-working industry the Conference Board reflects these basic influences on wages and wage trends. Detail data back to 1914 are given on the agricultural implement manufacturing industry, the automobile manufacturing industry, foundry and machine-shop products, machine and machine tool manufacturing, heavy equipment manufacturing, and the hardware and small parts manufacturing industry. The average hourly earnings of the wage earners in all these branches of the metal-working industry were more than doubled during the war period. The income of the workers in the agricultural implement industry was almost tripled during this period, increasing from 26.5 cents in 1914 to 71.5 cents during the fall months of 1920, an increase of 170 per cent. During this same period the average hourly wages in the automobile industry increased from 29.3 cents to 71.7 cents or by 144 per cent, the foundry and machine shop industry from 27.8 cents to 64.5 cents, or by 132 per cent, the machine and machine tools industry from 28.7 cents to 61.3 cents, or by 114 per cent, the heavy equipment industry from 30.8 cents to 74.3 cents, or by 141 per cent, and the hardware and small parts industry from 23.8 cents to 56.8 cents, or by 139 per cent. During the same period the cost of living increased by between 105 and 93 per cent, and the purchasing power of the dollar had been halved. It would appear, therefore, that in every branch of the metal-working industry of the nation the wage earners were materially better off financially at the close of the war than at the opening of that period, in that their income had been increased to a greater degre than had the various items entering into the cost of living.

Then came the business depression of 1921 with a drop in wages all along the line, which in general reached the low point during the third quarter of 1922. With the evolution of the present period of continued high industrial and business operations the wages of the employees in these various industries have slowly risen until in June, 1928, the following average hourly wages prevailed in the various industries: Agricultural implements 63.1 cents, or 138 per cent over 1914; automobiles 68.4 cents, or 134 per cent above 1914; foundry and machine-shop products 61.0 cents, or 119 per cent above 1914; machine and machine tools 60.0 cents, or 109 per cent above 1914; heavy equipment 65.1 cents, or 111 per cent above 1914; and hardware and small parts 54.4 cents, or 129 per cent above 1914. During the same 14-year period the items entering into the cost of living have increased that index by about 61 per cent. It would appear also that while the earnings of employees in the various branches of the metal-working industry today are from 2 to 12 per cent under those of 1920, the cost of living has decreased by some 21 per cent, and that since the fall of 1922 the wages have increased by from 19 per cent to 41 per cent, while the cost of living has increased by only about 4 per cent. From almost any angle the wage earners in the metal-working plants of the nation are financially in a materially better position today than at any time in the history of the industry.

In another section of the report an analysis is made of wages in the building trades. Here it is brought out that average hourly wages vary from 69 cents for laborers up to 162.3 cents for plasterers. The corresponding maximum figures are 90.6 cents and 175 cents.

Compared to the earnings of equally skilled workers in the manufacturing industries the earnings of the building trades artisans seem entirely out of line. It is pointed out, however, that no way has as yet been found to determine the continuity of work in the building trades or the total annual earnings of the various classes of workers. Consequently, any comparison of the economic status of the two groups is of doubtful validity. The most that can be deduced from the figures given is that to secure a given amount of money earnings the building trades worker has to labor for a much shorter time than does the factory worker.



Index numbers of average hourly and weekly earnings and employment

How to Improve Personnel Relations

Abstract of Committee Report to the 1928 International Railway General Foreman's Association, held September 18 to 21 at Chicago

IT IS an indisputable fact that the cultivation of industrial welfare is the cultivation of efficiency. It marks a new spirit of leadership, in that the impetus for doing this now comes from the top, where there is a growing sense of responsibility. It is much better that it should come that way, rather than by forceful demands from those below.

Improving personnel relations is almost meaningless and beyond the realm of achievement when employees constantly face unemployment. Our most needful advance is that towards reducing occasional unemployment. It is of little purpose to give employees the very best of conditions, when they labor constantly under the shadow that all may be swept away. It is too much to expect that employees will whole-heartedly enter into peaceful industrial relations until there is a direct and serious attempt, mutually between employers and employees, to eliminate this greatest of industrial sorrows.

Stabilization of Shop Forces

There is no problem of personnel of such vital concern as that of stabilizing employment, or rather reducing unemployment. The sub-committee of the Association of Railway Executives, which is studying the subject in conjunction with some appointees of the Interstate Commerce Commission, states that the main factors controlling employment on railroads are:

1. Lack of stability in railroad income
2. Lack of stability of traffic
3. Climatic conditions.

This committee further states that, to bring about a greater degree of stabilization of labor, there should be a sufficiently liberal margin between operating expenses and operating revenues, and also that the most influential single factor relating to stability of labor is the question of net earnings by the carriers. Individuals guard against "rainy days" by creating a surplus in good times. The question arises in many minds why railroads cannot create a special fund or surplus during the good months which may be used in lean months. There is no one answer to the question.

Stabilizing of shop forces on the railroads of this country would be a step ahead in the right direction. It would be impossible for us to say just how much money is lost through unrest among the employees, when the rumor of a reduction in forces starts circulating around our repair plants. It not only terrifies the individual directly involved, but to some extent demoralizes production in general. Fear is the worst enemy of mankind, and if anything would arouse a man's fear it is the thought of his baby and family being without the necessities of life.

We all appreciate the value of trained men, and it seems to be a waste of time on the part of the employee to work several years at a line of business and then be cast aside. He has lost training in outside industries; and the railroad has lost money through the expense of training him and not reaping the benefit of his training.

It also creates a hazardous condition to have to employ a large number of new men in a plant during a busy period. From a safety point of view we get an increase in the accident column. We are similarly affected in a reduction of forces, especially where seniority prevails. When depressions come and the young employees are laid off, leaving the older employees to do the climbing over locomotives and cars, it adds materially to accident risks.

Let us consider a concrete condition to which we must work, if we would stabilize our shop forces. If the sum total of assigned mileage on a railroad is ten million miles and the average shop man-hours required to restore one mile to the equipment is one, we, desiring to maintain normal conditions, would have to work one man-hour in the shop for every mile run on the road. Then, if we used 50 per cent of our total mileage per year under normal business conditions, we would have to work five million shop man-hours per year. Supposing our business fell off to an average of 50 per cent of a normal business year, and we maintained a normal force of five million shop man-hours at the end of a year, we would have built up our stored energy to seven million, five hundred thousand miles. This would put us in good condition to meet the demands of the peak business that is more than apt to come, we will say, the next year. If our business increases to an average of 200 per cent over the previous year of depression, at the end of this busy year we will have two million, five hundred thousand miles of stored energy left in our power.

Mr. L. F. Loree has a commendable plan, to stabilize employment by creating a flexible working day whereby the same working force may be constantly employed. In brief, the plan provides for four months' work at ten hours a day during the four good months, four months of regular 8-hour days, and for the remaining four lean months 8 hours a day for five days a week.

Other plans have been suggested and we can expect to see, in the near future, some decided action. Every foreman, though removed from personal fear of unemployment by virtue of his position, should not be calloused to the suffering caused by unemployment. He should lend his best efforts on his own road to the working out of a plan to reduce unemployment, and to effectively carrying out this program.

The word "discipline" to most people carries the meaning of physical punishment. The more proper definition of the word is "mental or moral training and education." From the very beginning of railroads,

there have been strict codes of rules for employees, especially trainmen and enginemen, on account of the hazardous nature of the industry.

In early railroad practice, punishment was imposed in the form of fines. Later these fines were credited to a fund to relieve distress, and still later, because of the attitude of the brotherhoods, the fine system was abolished and the suspension system inaugurated.

The most powerful instrument a general foreman can use, and the one upon which he must rely, is a just but inexorable strictness. There are too many supervisors who seem to be willing to forego their chances of success for the chance of being popular or well liked. Discipline to be effective must be prompt, uniform and impartial, severe enough to be felt, and of lasting benefit. Too much cannot be said of the absolute necessity for uniformity and impartiality of discipline.

The most successful supervisor is the one who can handle his men in a manner wherein it is seldom necessary to invoke disciplinary measures. This can be done without the slightest breakdown in shop morale and production. Among the primary considerations, in the successful handling of workmen, is the problem of instilling into the whole organization the feeling that every man's work is important and should be of first-grade quality. There is no industry so capable of fascinating employees and arousing pride as our railroads.

A foreman or supervisor must be sold on doing what is right, and must be 100 per cent loyal before he can himself think of administering discipline. There are cases where foremen should be disciplined instead of the workman, and discipline should be handled through an investigation by a neutral party or the head of a department, such as general foreman or superintendent of shops (with stenographer present).

There are many cases where loyal and good employees have been disciplined by foremen, who had direct charge of them, not for insubordination, but for foreman's mistakes or personal grudges. In cases like this, a good employee has no means to defend himself. Therefore, no employee should be disciplined until he has had a hearing, and the right to have a representative present.

It is necessary to reprimand an employee even if it is his first offence. This may be done by giving him a good talking to, privately, and if necessary place a record suspension against him and explain to him what it means and what a repetition means. A record of suspension is a mark placed against an employee's record for violation of the company's rulings. It is customary to specify a number of days on the record of suspension and if the employee again violates a ruling, he would be actually suspended the number of days placed against him on his record. This will wake up an employee, and he will know what is hanging over his head. The last resort for an undesirable employee is discharge.

Record should be kept of employees on employment cards as to their standing. No investigation should be held without a stenographer present, taking down all that is said. The foreman in direct charge of the employee should be present if possible, depending on what the case may be.

Outside Activities

It is understood that "outside activities" refers to those activities carried on by a company and its employees outside of working hours. It is distinctly noticeable however, that in practically all of the activities the workers look to their foremen to assume the lead. A number of the activities are supposed to be governed entirely by employees, but behind the successful ones will be found the guiding hand of a foreman or group of foremen. Where the interest of the supervisors waned in a certain activity, so did that of the workmen.

The characteristics of a man who is a successful leader of outside activities, frequently do not coincide with those of the average foreman. Just as a foreman is a specially trained man in his department, so is the activity director a specialisit in his field. It is said that, on many roads, the foremen are expected to be both. This is a difficulty assignment. With all due respect to our respective employers, there are many general foremen and shop supervisors who are finding that these activities interfere seriously with the discharge of their normal shop duties. One general foreman writes that he would have to be away from home 21 evenings each month if he attended all the meetings he is supposed to attend.

In shops where there are numerous foremen it is suggested that the foremen choose various activities, and lend their best efforts to them rather than attempt to take part in all activities, in a half-hearted manner. Every foreman has some kind of a hobby, and if allowed to follow this, he will not fail to arouse enthusiasm in the workers about him.

Should Depreciation Be Hidden?

Are most company officials blind to the need of providing for proper depreciation of equipment, or are they deliberately keeping their stockholders in the dark as to their policy?

Which stockholder is in the safer position, the one who knows from the financial statement of the company how much was written off for depreciation, or the one who cannot tell because his statement gives no information?

Next week there will be a short article on this subject, based on the published statements of some 600 corporations. It is surprising how many of them are completely reticent about how they figure depreciation.

The Swing of the Pendulum

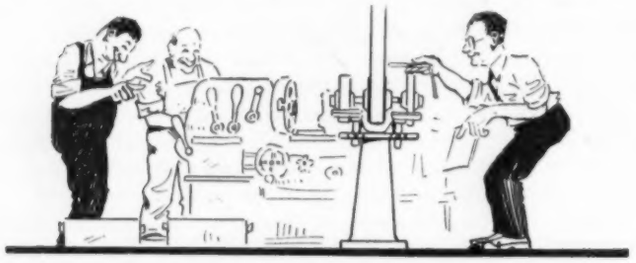
By W. King

STATE inspector Jones was being guided about the plant. It was in the tool room that he halted and cast critical eyes at two grinding wheels, open and unguarded, and mounted on a single pedestal.

"Seems to me," he commented, sourly, "that we ordered these wheels guarded before."

The guide remarked that he recalled no such order. The inspector merely grunted, and jotted down a few notes.

Two days later the firm received a written notice from the Commonwealth to have those two wheels guarded, in an approved manner and within the time specified, or suffer the penalty imposed for such infractions of the State requirements. Because of the peremptory tone of



the order and the shortness of time allowed, the general manager decided to have the guards made special, right in the plant.

Consequently, a draftsman came down to the tool room next morning, armed with pad, pencil, and rule, and proceeded to take measurements.

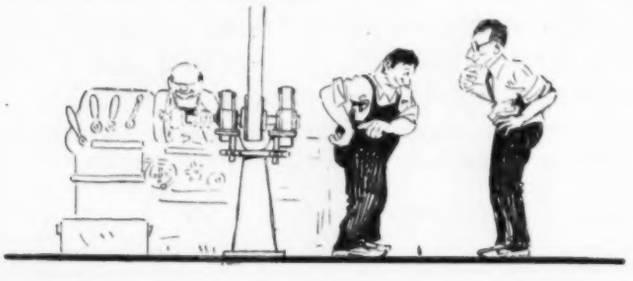
Two tool makers observed, somewhat sneeringly, what was taking place. The elder of the two, a good worker of the foreign type, with a nod of his head toward the busy draftsman, spoke to the other toolmaker in his native tongue.

"Look at that fellow. He thinks he can put some guards on those wheels; all foolish. He doesn't know that after everything is fixed up and fitted together, it will be so unhandy and slow that we will take the guards off again. The wheels wear and get smaller; then the guards are in the way. He doesn't know that—let him find it out."

The draftsman, familiar with the language spoken, heard clearly, and smiled tolerantly.

One week later the guards were set in place, nicely equipped with a front section which was adjustable to take care of the wear of the wheel.

A few months later, on one of his numerous trips to the tool room, the draftsman paused a minute and surveyed the new guards. The tool maker, the same man whom the draftsman had overheard, ambled over and pointing to one of the guarded wheels. Somewhat sheepishly he said in English:



"That's a very good job you did—very good."

The draftsman, surprised, eyed the other questioningly. "Yes?" he said.

"Yes, very good. Yesterday I was grinding a tool and the wheel bust; flew all over inside the guard. If there had been no guard I would surely have gotten my face smashed up."

And thus we have, again, a working example of the old admonition concerning life in the proverbial glass house.

Laying Out Involute Gear Teeth

By J. S. Boller

INVOLUTE curves for gear teeth can advantageously be laid out by a method involving Professor Rankin's method of approximating the length of an arc of a circle. This method is illustrated in Fig. 1. To find the length of the arc ABC, whose center is at O, draw the chord AC extended. Lay out CD equal to $\frac{AC}{2}$ and draw CE perpendicular to OC. With D as a center, strike an arc whose radius is equal to DA, cutting CE at F. Then CF will be nearly equal to the arc ABC, but will be shorter than the true arc by an amount equal to about 0.04 per cent for an arc of 45 deg. The percentage of error decreases rapidly as the angle AOC decreases.

The use of this method in laying out gear teeth is illustrated in Fig. 2. Lay out a base circle with center at

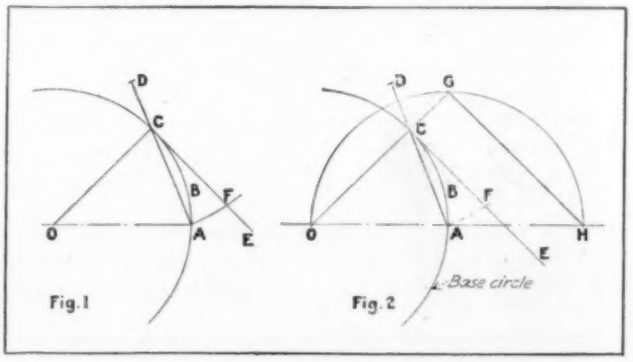


Fig. 1—Rankin's method of approximating the length of an arc of a circle. Fig. 2—Laying out the involute curve

O. Draw line OA extended. With OA as a radius and A as a center draw a semicircle OGH. Draw OG at any desired angle with the line OA. Draw GH. As the triangle OGH is in a semicircle, angle OGH is a right angle. Draw CE parallel to GH and tangent to the base circle.

An involute beginning at A and curving upward as shown by the dotted lines will have one point on the line CE designated as F. The distance CF is equal to the arc ABC. This point F is found by the method shown above, which can easily be followed as similar parts in both figures are designated by the same letters.

In laying out gear teeth several points must be found by using different values for the angle AOH. The semicircle is used for securing the right angle because it is more convenient than the average protractor.

Hardening Drop-Hammer Dies

By John C. Kielman

Engineer, Forge Plant, New Departure Manufacturing Company

Dies of open-hearth and alloy steels are quenched in water or oil and are drawn to a hardness indicated by a scleroscope test

DIES for drop hammers are subjected to severe usage, and because of that fact they present rather more than ordinary difficulties to the casual hardener. They must be sufficiently hard upon the face to resist any tendency toward deformation, yet not so hard as to be likely to crack under repeated heavy blows of the hammer.

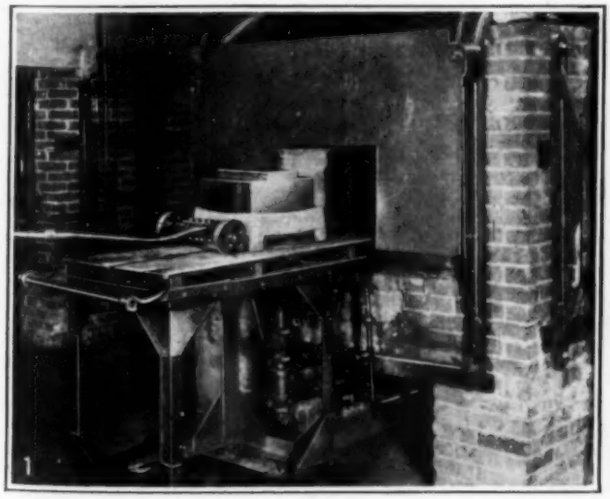
In the forge plant of the New Departure Manufacturing Company, Bristol, Conn., several hundred drop-hammer dies are made and hardened in the course of a year. They are used in drop hammers ranging from 1,000 to 3,000 lb. capacity to produce form tools and cutters of high-speed steel, tool-steel knife fingers for ball-heading machines, and wrenches and similar tools used about the plant. As loss or failure that can be charged against the hardening department is practically non-existent, a study of the methods and practices of this plant should be of interest to readers of the *American Machinist* who have occasionally to harden similar dies.

Various kinds of steels are used from which to make the dies, according to the nature of the material and the shape of the piece that is to be forged in them. These varieties include straight-carbon open hearth, chrome-molybdenum, and vanadium steels. The open hearth steel contains from 0.60 to 0.80 per cent of carbon and 0.60 to 0.70 per cent of manganese. The composition of the molybdenum steel includes 0.50 to 0.60 per cent of carbon, 0.50 to 0.80 per cent of chromium, 1.25 to 9.50 per cent of nickel and about 0.20 per cent of molybdenum. The vanadium steel has a slightly higher carbon content and a small percentage of vanadium.

The method of hardening the different steels is the same, varying only in the matter of temperature and quenching mediums. The heating is done in the under-fired, semi-muffle furnace shown in Fig. 1, in which oil is used as a fuel. The dies are placed face downward in heavy trays of cast iron that are partly filled with powdered charcoal, which has been found to be a very effective medium to prevent oxidation and consequent scaling of the face. The furnace is charged while cold and the temperature is raised at the rate of about one hour for each inch of minimum dimension of the average die; the dies being selected so that all in any one charge are approximately of the same size.

Quenching temperatures and mediums are, of course, suited to the kind of steel undergoing the process. Dies of open-hearth steel are heated to 1,440 deg. F. and are quenched by partly immersing them in water. The vanadium and molybdenum steels are heated to 1,475 deg. F. and quenched by submerging them in oil. Both oil and water tanks are provided with vertically-placed nozzles some distance below the surface of the liquid, so that a strong current of the quenching medium is directed against the face of the die. The temperature of the quenching medium is maintained as closely as is conveniently possible to 70 deg. F.; in the water tank by a constant flow of fresh water; and in the oil tank by circulating the oil through a cooling system.

Special tongs, shown in Fig. 2, are employed to convey



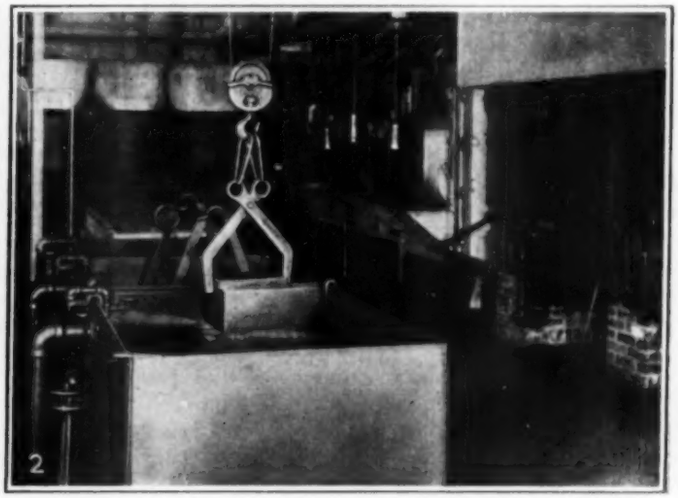


Fig. 1—Dies are heated for hardening in under-fired, semi-muffle gas furnaces. They are placed in the cold furnace, which is then brought up to hardening temperature at the rate of about one hour for each inch of the minimum dimension of the dies. Fig. 2—The die is picked up from the apron of the furnace by special tongs. A grid in the tank supports the face of the die about 3 in. under the surface of the water. Jets of quenching liquid are directed toward the face of the die to insure a rapid change in the temperature of the surface metal

Fig. 3—The dies are drawn to a scleroscope hardness of 75 to 70 on grids, under which open gas flames are burning. The instrument is applied at frequent intervals, and when the desired reading is shown, the dies are set aside to cool in the air

the heated blocks from the apron of the furnace to the quenching tanks. Shallow holes, drilled for the purpose in each end of the individual die blocks, engage projections at the ends of the tong jaws to lift the blocks. The tongs are suspended from an electric hoist upon the beam of a jib crane, which provides easy and convenient means of transporting them to and from the furnace and tanks.

Dies of vanadium steel are submerged face downward in oil agitated by jets from nozzles at the bottom of the tank. When a temperature between 300 and 400 deg. is reached, the die is removed from the tank, wiped clean of oil, and then deposited face upward upon a grid, beneath which an open gas flame burns. Here, as shown in Fig. 3, the drawing proceeds until a scleroscope, applied at frequent intervals, registers a hardness of 75 to 70, whereupon the die is set aside to cool in the air.

Dies of open-hearth steel are quenched by partly immersing them in water. About 3 in. below the surface of the water in the tank is a grid upon which the hot die is placed, face downward, by the electric hoist. The die is not allowed to cool completely at this stage, but when the face has reached a temperature of approximately 400 deg., as nearly as can be judged by the hardener, it is transferred to the oil tank where it is submerged in the oil to allow the temperature to equalize. While still at about 300 deg. it is removed to the gas grid to be drawn to scleroscope test, as before described.

Molybdenum-steel dies are quenched by submerging them in oil until cooled to about 250 deg., when they are

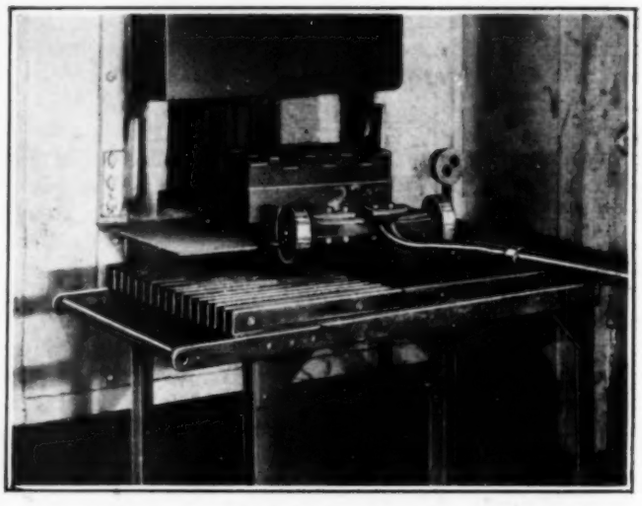


Fig. 4—Molybedenum-steel dies seem to require a long period of drawing, hence they are placed in an electric furnace which is heated to a temperature of about 900 deg. F. This heat is continued for from 12 to 14 hours

placed immediately in an electrically heated furnace to be drawn. Dies of this steel seem to require drawing for a long time in order to secure best results. The electric furnace may be seen in Fig. 4 with a die about to be run in. The dies are subjected to a drawing temperature of about 900 deg. F. for a period of 12 or 14 hours.

Importance of Specifications—*Discussion*

By S. Kupper

GOING further with the comments of A. L. Walker on page 205, Vol. 69, of the *American Machinist*, I believe that one of the most important phases of engineering work is the drawing up of adequate specifications. Design requirements must govern, but the specifications must also be in accordance with trade practice.

Specifications are most essential if the product is to be purchased under competitive bidding. Much of the secret of good purchasing lies in good specifications which the vendor must live up to. Good specifications prevent a concern paying for a brand which has been built up at high advertising cost when the same article can be purchased elsewhere at less cost. Purchasing to specifications is not particularly popular with vendors who have in their regular selling price the cost of establishing their trademark. Purchasing to specifications may be made on a level of quality which is just good enough and not too good for the purpose at hand. At times specifications may well be modified to suit the needs of the vendor. Slight and unimportant modifications may bring considerable reductions in quoted price when the revision brings the product within the standards of more of the vendors.

The results of an inquiry into wage systems, recently conducted by the Industrial Relations Committee of the National Metal Trades Association, indicated that 54 per cent of member firms have adopted some kind of bonus system and that this method of payment applies to more than a quarter of the persons employed by these firms. The majority of the 600 replies received indicated that the introduction of a bonus system effects an increase in the workers' earnings and a lowering of costs. Experience indicates that the success of such schemes depends on good administration more than on the type.

An Analysis of the P. & W. Gear Shaving Process

By H. D. TANNER

Manager, Gear Division, Pratt and Whitney Company

This process is one of generation and takes advantage of the simple development of the involute curve—Several practical considerations concerning its application

THE two present methods of generating involute gear teeth, both spur and helical, in soft gear blanks, are the hobbing method and the gear shaper method. Both of these come under the classification of forming-generating in that the form of the gear tooth generated, while it differs from the form of the cutter used, depends partially upon the form of the cutter.

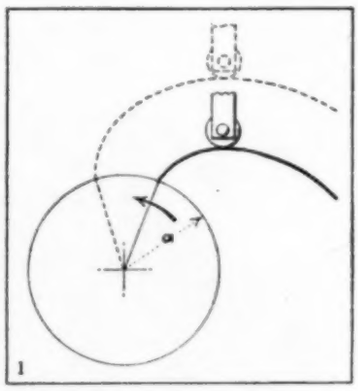
Gears are usually hobbed at the angle at which they are to run; that is, a 20-deg. gear is hobbed with a 20-deg. hob, although it can be hobbed at angles greater than 20 deg. and also at lesser angles, even down to 0 deg., but a hob is an impractical tool at very low angles.

Gears are also usually shaped at about their running angle, although the generating angle could be varied slightly if there were reason for it. The shaper cutter, however, cannot generate involute teeth of any practical height at low angles. For instance, the lowest angle at which a 21-tooth cutter can generate a full involute on a standard full-height, 15-tooth gear is 16 deg., 9 min. and 1 second.

Abstract of a paper presented on October 12 at a joint session of the American Gear Manufacturers' Association and the Machine Shop Practice Division, American Society of Mechanical Engineers.

The gear shaving process, the invention of James H. Barnes of Dayton, Ohio, is a practical method of generating involute spur or helical gears at 0 deg. The involute curve is generated by a point in a straight line rolling on a circle. A simple conception of this curve, as in Fig. 1, is that of a uniform-rise cam, where the rise per revolution along a line tangent to a circle of radius *a* is equal to the circumference of the circle. If this cam is revolving at a uniform rate, the cam roll will rise at a uniform rate. If the cam revolves in the reverse direction, the roll will fall accordingly.

If now, as in Fig. 2, we place a roughed-out cam on the same center, place a cutting tool with its edge on the tangent line and cause it to move up or down with the cam roll, the revolution of the rough cam against the cutting edge will remove the surplus material and leave the second cam exactly like the first, or master cam. In the actual machine, a large cam with two opposing involutes and two cam rolls are used. Two cutting tools are also used and the cycle is as shown in Fig. 3. At the left the gear is in the starting or loading position and the tools are



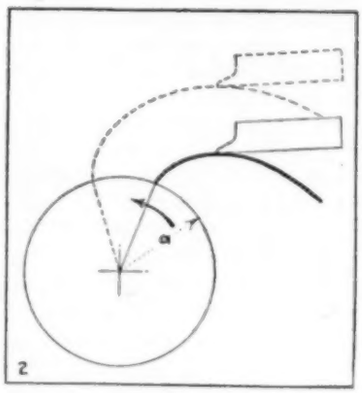


Fig. 1—The involute curve as a uniform-rise cam. Fig. 2—By substituting a cutting tool with its edge on the generating tangent line for the roller of Fig. 1, an involute curve can be generated. This is the principle of operation of the Pratt & Whitney gear shaver

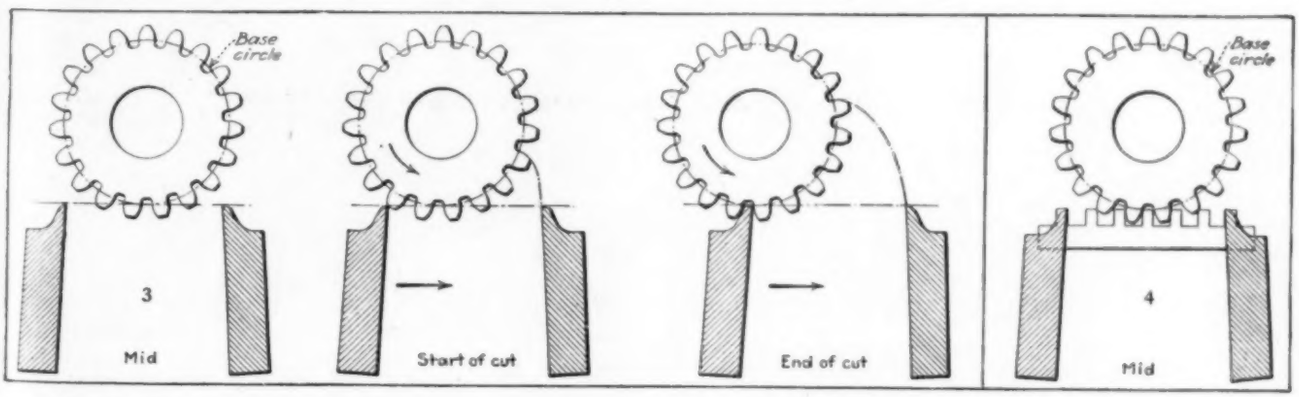


Fig. 3—Diagrammatic cycle of the Pratt & Whitney gear shaving machine, showing three successive stages of development. Fig. 4—Comparison with the process of generation by a 0-deg. rack

shown with their cutting edges on a line tangent to the base circle of the gear. In the center the gear has revolved in the direction shown by the arrow, the tools have been moved, at exactly the correct rate, to the right along the tangent line and the left-hand tool has started to cut an involute curve on a tooth. At the right the same tool has come into contact with the base circle of the gear and has completed its cut. At this point the movement of the gear is reversed, the tools move back to the left, and the right-hand tool, following the path of the dot-and-dash line, finally cuts an involute on a tooth. The gear is again reversed and, while the tools are returning to their original position, lags behind just enough to index one tooth.

Fig. 5—The master involute cam for shaving an 18-tooth, 6-D.P., 20-deg. gear. It is made of S.A.E. 10,115 steel, hardened, seasoned and ground and is the key member of the Pratt & Whitney gear shaving machine

It now becomes apparent that the process is one of 0-deg. generation, and that the active profiles of the gear teeth are generated by rolling the gear in mesh with a 0-deg. rack, as in Fig. 4. The active profiles of this rack are the top edges of its teeth, which coincide with the cutting edges of the tools. The remainder of the profile of the rack does not come into contact with the gear. We are, then, required to make tools with straight cutting edges, slightly longer than the face of the gear to be cut, and to place the tools in the shaving machine with their edges lying in a plane tangent to the base cylinder of the gear. If the edges are parallel to the center line of the gear, a spur gear will be produced. If they are parallel to each other, but at an angle to the center line of the gear, a helical gear will be produced.

All expense connected with the making of any precision form used in the machine is confined to the master involute cam. Fig. 5 shows a cam for an 18-tooth, 6-D.P. 20-deg. gear. Cams are made of S.A.E. 10,115 steel, hardened, seasoned and ground. They are 12 in. wide across the tangent to the base circle and $1\frac{1}{2}$ in. thick. All of the machining operations are conventional with the exception of the milling and grinding of the involute profiles.

The cams are milled on a standard vertical milling machine with a circular milling attachment and a special end bracket arranged for differential change gears. The machine is set up with a milling cutter in the position of the roll in Fig. 1 and the change gearing used is such that the cam makes one complete revolution while the table travels a distance equal to the circumference of the base circle of the gear for which the cam is being made. This being only a roughing operation, a lead is used which is within 0.010 in. of correct for a full revolution of the cam.

The cams are ground on a standard cylindrical grinding machine fitted with a special generating fixture. The cam is mounted on an arbor having a disk of base circle diameter on each end and this assembly is rolled on a steel track, which is the tangent line of Fig. 1. The grinding wheel is placed with its center in the plane of this flat track and an involute is very accurately generated. The fact that the cam is rolling on a stationary line instead of revolving against a moving line, as in the machine, does not alter the relative motions.

To prevent the disk from slipping on the track, steel bands are used, as in some gear tooth grinders. The bands are wrapped around the base circle disks close to, but not in contact with, the track, the disks at this point being reduced in diameter about the thickness of one band.

In Fig. 6 is shown a front view of the machine with the guards removed, showing the master cam and one of the roll housings. As the machine has been described in detail in the *American Machinist* on page 810, Vol. 68 (q.v.), no further description will be given. In the first pass of the tools all stock in excess of 0.004 in. above finished size is removed. When all teeth have been cut once the blades are automatically moved together 0.004 in. and all teeth are again cut, 0.002 in. being removed from each side of each tooth. A third and fourth cut of 0.001 in. each per tooth side is taken and the machine is automatically stopped. The machine speed is 45 cycles per minute.

We prefer to rough cut gears in a hobbing machine, although a gear shaper can, and sometimes must, be used. Our preference is due entirely to the more favorable shape (for gear shaving), produced at the base of the tooth by the hobbing method. A tooth section of the type of hob used is shown in Fig. 7. To produce a definite undercut in the gear the point of the hob is made

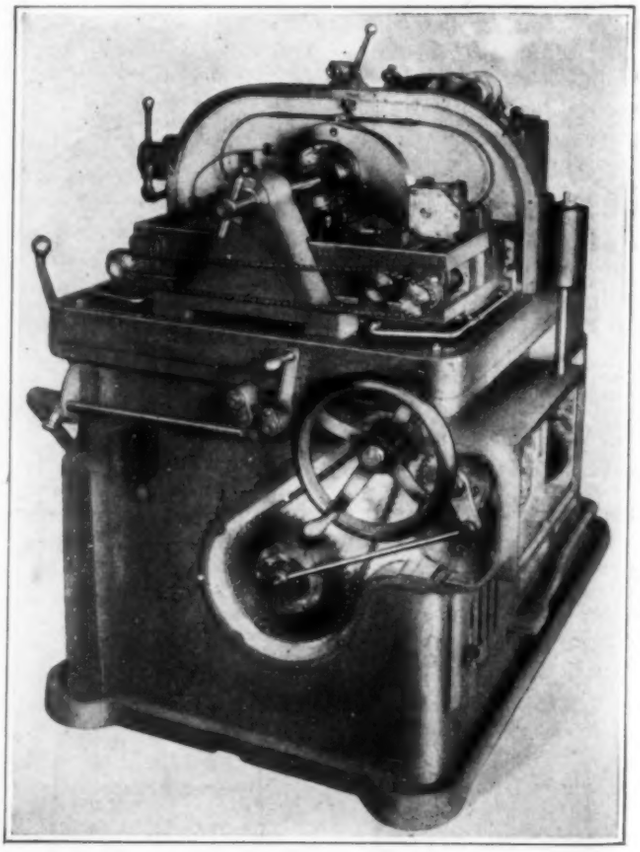


Fig. 6 — Front view of the shaving machine with the guards removed, showing the master cam and one of the roll housings

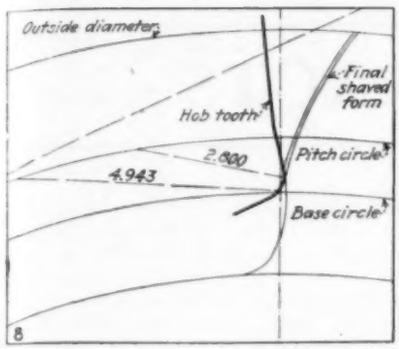
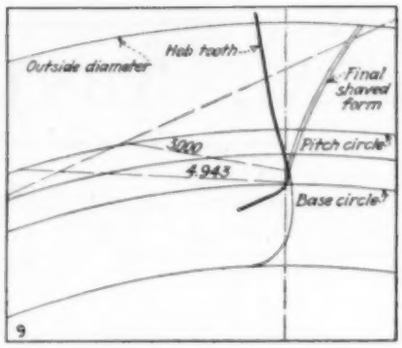
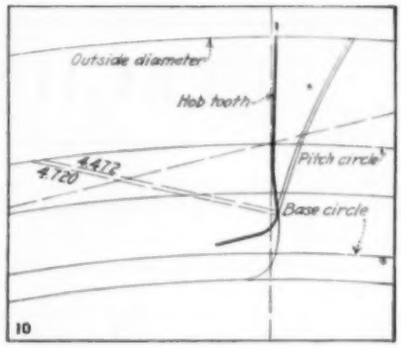


Fig. 8 — Roughed and finished profile of a 17-tooth, 20-deg. gear hobbed with a 20-deg. thick-point hob. Note the clearance obtained near the base circle



to provide for over-run of the shaving tools. Fig. 9—The same gear roughed with a 15-deg. thick-point hob, showing resultant increase in the length of



the line of action. Fig. 10—The mating 33-tooth gear roughed with a 15-deg. hob showing that there is no loss of action due to hobbing

thicker than standard by from 0.007 to 0.010 in. on each side. All hobs are made to generate at a pressure angle of 15 deg. as this produces more nearly the desired shape in the undercut curves. For the same reason, all gears are cut to full Fellows depth. Otherwise, hobs are made and used as in regular production roughing.

In Fig. 8 is shown the roughed and finished profile of a 17-tooth, 20-deg. pressure angle gear. It has been hobbed with a thick-point, 20-deg. hob to a depth of 2.250 in. instead of the standard 2.157 in. on a 1-D.P. gear. The hob profile is shown just as it is finishing the gear profile. The outer involute profile and clearance curve is the gear as hobbed and the inner profile is the finished shaved profile. The involute profile only is shaved, the remainder of the tooth being left as produced by the hob. That part of the involute starting at the base circle has been removed by the hob to give the shaving tools a clearance space to cut into. The undercut curves are designed to cross the base circle 0.004 to 0.006 in. inside of the finished involute curve. We find 0.004 in. to be as small as is commercially practical. The line 4.943 is the relative length of the theoretical line of action to the pitch circle of this gear when it is in mesh with a 33-tooth gear on a standard center distance. The line 2.800 is the actual line of action resulting from the removal of the base of the involute. In Fig. 9 is shown the same 17-tooth gear roughed with a thick-point, 15-deg. hob to the same depth. The involute curve is identical to the first gear and the undercut curve crosses the base circle at the same point, but at a different angle, which removes less of the involute, resulting in an increase in length of the actual line of action to 3.000 in. Generating at low angles is more effective in this respect, the more teeth there are in the gear.

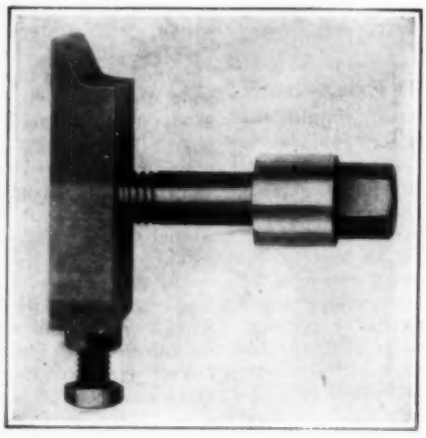


Fig. 11—Shaving tool with its clamping bolt and supporting screw. The tool is sharpened by grinding across the cutting edge. The front surface is usually slightly concave

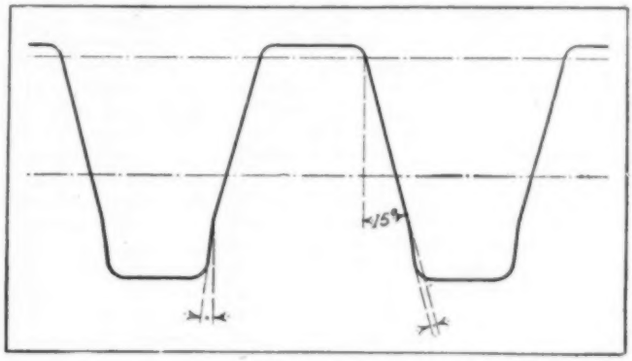


Fig. 7 — Normal section of a roughing hob suitable for preparing gear blanks for the shaving process

In Fig. 10 is shown the mating 33-tooth gear, roughed and finished under the same conditions. The theoretical line of action to the pitch line is 4.472 long and the possible is 4.720. The possible being longer than the required, there is no loss of action in this gear from this method of roughing, although there would have been if a 20-deg. hob had been used. The maximum possible number of teeth in contact with this pair of gears is 1.595 and the actual, in this case, is 1.265. As the loss of action comes from a removal of active profile from the 17-tooth gear close to its base circle, where its use causes a high relative sliding velocity, the loss is not very keenly felt.

One of the shaving tools is shown in Fig. 11 with its clamping bolt and its supporting screw and check nut which take the thrust of the cut and also locate the cutting edge at the correct height in the machine. Tools are sharpened by grinding across the cutting edge and advantage is taken of the ease with which the edges can be honed. In addition, the front surfaces of the tools are usually ground to a concavity of 0.0005 in. per in., the curved cutting edge thus produced resulting in a gear tooth thicker in the center of its face than at its ends.

Any carbon tool steel which will hold a keen edge at a hardness of from 63 to 65 on the Rockwell C scale is satisfactory for cutting tools. The tools will cut from 500 up to 1,200 teeth after grinding, depending largely upon the machineability of the gear material. A honing of the cutting edges, in the machine, will usually give half as many more before the tools need regrinding. The usual cutting compounds are satisfactory and no unusual heat-treatment of the gears before cutting is necessary, although we prefer the material a little harder than is customary.

· · TECHNICAL · ABSTRACTS ·

The Care and Use of Automatic Sprinklers

Among the first considerations when choosing a sprinkler system are the kind of building and the nature of the operations conducted in it. A concrete building equipped with machines and having both raw stock and finished products of metal only presents a less serious fire hazard than a frame building, in which both the raw stock and the finished product are of highly inflammable material. One sprinkler head for every 80 sq.ft. of floor area is sufficient usually to provide ample fire control.

Storing raw materials or finished products in such a way as to interfere with the distribution of the water from the sprinkler head is a serious handicap to effective sprinkler protection.

Sprinkler heads are subject to deterioration through corrosion and "loading." Corrosion due to moisture and acid vapors is likely to affect the parts in the sprinkler head so that they will fail to function as intended. Protection against corrosion has been obtained when sprinkler heads have been coated with wax, which in no way interferes with the action of the head as the wax melts at a lower temperature than the fusible solder used for keeping the head closed. At times the effect of loading sprinkler heads with dusts, fibers, lints, and oils is just as serious as corrosion. Some of these materials absorb moisture and harden when they eventually dry out, thus forming an incrustation which acts as a heat insulator, and is likely to seal the heads so that they cannot open on time if at all. In locations where either corrosion or loading is prevalent, relief may be had by using the silica-bulb head. The ordinary low-test silica bulb is designed to operate at 135 deg. F., and is somewhat quicker in action than a head of the usual solder type. The silica bulb does not readily lend itself to loading, and is unaffected by moisture and acid vapors. For the ordinary type of sprinkler head an annual coating of red lead paint is effective in preventing corrosion.

Some Precautions Necessary

Some of the precautions necessary to keep sprinkler systems in good operating condition are as follows: All main control valves should be sealed in the open position in an approved manner; the alarm valve should be tested at least once a year; proper air pressure should be maintained on dry systems at all times; dry-pipe valves and the water pipes leading to them must be protected against freezing, and dry-pipe valves should be tripped at least once a year.

A careful analysis of fire records reveals the fact that 98.9 per cent of the cases of unsatisfactory sprinkler operation have been due either to lack of maintenance of the equipment or to conditions which prevented the proper distribution of the water.—*The Travelers Standard*, October.

Two Fundamentals of Satisfactory Executive-Subordinate Relationships

The more or less recent development of what may be called the technique of executive leadership, which is applicable to practically any executive-subordinate relationship, contains two factors that are fundamental. The first factor is the responsibility of the executive to interpret properly to his subordinate the spirit and policies of the management. The second, which should receive special consideration, is the matter of maintaining frank relationships between executives and subordinates.

As an example of interpreting the spirit and policies of the management, it is absolutely necessary for the executive to interpret the management's compensation policy as his own. Any attempt to do otherwise results in "selling" himself to his subordinate at the expense of "unselling" the management. He thus attracts a false loyalty to himself, while at the same time developing a disloyal attitude on the part of the employee towards the organization. Such a practice obviously undermines the organization structure, and breaks down morale.

Reasons Should Be Explained

The correct procedure, should the executive be a foreman, would be to explain the reasons for the various policies, regulations, procedures, wage rates, and working conditions, immediately upon hiring a man. If the foreman does not agree with all these questions, he should take steps, through the proper channels, to recommend changes to the management, but he should not, under any circumstances, indicate to his subordinates that he is not in full agreement with existing conditions.

The second factor, that of maintaining frank relationships between executives and subordinates, should receive special consideration, although frequently executives lack the courage to do so. It is well to interview the subordinate periodically, say three or four times a year, and tell him frankly just where he stands, what progress he has made, and why his rate of pay is what it is. Furthermore, he should be told what mistakes he has made and how he can avoid them in the future, and what his shortcomings are. If he has ability to qualify for a higher grade job, point out the opportunities for promotion and tell him how he can make himself worthy of it. In no case keep a mediocre employee from year to year because of soft-heartedness. There usually comes a time when a misfit individual must be let go, and if this is deferred too long, he will be unable to readjust himself to a suitable vocation. It is far more humane to act courageously in these matters. But above all, make certain that each of your subordinates knows that he can at any time discuss with you any problem, including salary adjustment or complaints. —Harold B. Bergen, *The Management Review*, October.

Diamonds Used for Cutting Metal

Tools pointed with diamonds have been used for years to dress grinding-wheels and to do cutting work in hardened steel and other materials that are too hard to be cut by steel tools. It seems to be a more recent discovery that they can be used economically in machining a number of softer materials, particularly those on which steel tools do not have satisfactory life.

Among the materials most commonly considered for machining with diamond tools are hard rubber, vulcanized fiber, ebonite, vulcanite, mica, "felt" paper-rolls, bronze, bearing metal, aluminum, copper, Monel metal, and malleable iron. All these materials are more severe in their effects upon steel turning-tools than their hardness and tenacity seem to indicate, or it is difficult to finish them smooth with a steel tool.

It is said that economical results are obtained also in turning cast iron, at least under certain conditions. For the automotive industry, it is probable that most of the interest in the application of diamond tools will be centered on their use in turning bronze and other bearing metals, aluminum alloy, copper and Monel metal, at least for the present.

The tool can be run at such high speed that it is practical to take a very fine cut, this, with a marked freedom from tearing effect, making possible a smoothness of finish that can be obtained with no other known method of machining.

In turning aluminum, copper and malleable iron, the diamond tools does not tear the metal and leave it rough, as does a steel tool. To make the most of its ability to give a smooth finish, the feed of the tools should be small, and very high speed can be attained without damage to the tool or to the work.

Two types of diamond are used for tool points. One form, which comes from Brazil, is a conglomeration of microscopic crystals. Most of these stones are black, but some are dark green, brown or yellow. The black stones are known as carbon, and often, also, as black diamonds. Because of the absence of cleavage planes, carbons are less liable than borts to fracture.—S.A.E. *Journal*, October.

Table for Figuring Weights of Press Stock

Width Inches	Thickness of Stock, Inches 0.025	0.032	0.042	0.058	0.062	0.072
1/16	0.442	0.566	0.743	1.026	1.097	1.273
1/8	0.884	1.132	1.486	2.052	2.193	2.547
3/16	1.327	1.698	2.228	3.077	3.290	3.820
1/4	1.769	2.264	2.971	4.103	4.386	5.094
5/16	2.211	2.830	3.714	5.129	5.483	6.367
3/8	2.653	3.396	4.457	6.155	6.580	7.641
7/16	3.095	3.962	5.200	7.181	7.676	8.914
1/2	3.538	4.528	5.942	8.206	8.773	10.188
9/16	3.980	5.094	6.685	9.232	9.869	11.461
5/8	4.422	5.660	7.428	10.258	10.966	12.735
11/16	4.864	6.226	8.171	11.284	12.063	14.008
3/4	5.306	6.792	8.914	12.310	13.159	15.282
13/16	5.749	7.358	9.656	13.335	14.256	16.555
7/8	6.191	7.924	10.399	14.361	15.352	17.829
15/16	6.633	8.490	11.142	15.387	16.449	19.102
1	7.075	9.056	11.885	16.413	17.546	20.376
1 1/16	7.517	9.622	12.628	17.439	18.642	21.649
1 1/8	7.960	10.188	13.370	18.464	19.739	22.923
1 3/16	8.402	10.754	14.113	19.490	20.835	24.196
1 1/4	8.844	11.320	14.856	20.516	21.932	25.470
1 5/16	9.286	11.886	15.599	21.542	23.029	26.743
1 3/8	9.728	12.452	16.342	22.568	24.125	28.017
1 7/16	10.171	13.018	17.084	23.593	25.222	29.290
1 1/2	10.613	13.584	17.827	24.619	26.318	30.564
1 9/16	11.055	14.150	18.570	25.645	27.415	31.837
1 5/8	11.497	14.716	19.313	26.671	28.512	33.111
1 11/16	11.939	15.282	20.056	27.697	29.608	34.384
1 3/4	12.382	15.848	20.798	28.722	30.705	35.658
1 13/16	12.824	16.414	21.541	29.748	31.801	36.931
1 7/8	13.266	16.980	22.284	30.774	32.898	38.205
1 15/16	13.708	17.546	23.027	31.800	33.995	39.478
2	14.150	18.112	23.770	32.826	35.091	40.752
2 1/16	14.593	18.678	24.512	33.851	36.188	42.025
2 1/8	15.035	19.244	25.255	34.877	37.284	43.299
2 3/16	15.477	19.810	25.998	35.903	38.381	44.572
2 1/4	15.919	20.376	26.741	36.929	39.478	45.846
2 5/16	16.361	20.942	27.484	37.955	40.574	47.119
2 3/8	16.804	21.508	28.226	38.980	41.671	48.393
2 7/16	17.246	22.074	28.969	40.006	42.767	49.666
2 1/2	17.688	22.640	29.712	41.032	43.864	50.940
2 9/16	18.130	23.206	30.455	42.058	44.961	52.213
2 5/8	18.572	23.772	31.198	43.084	46.057	53.487
2 11/16	19.015	24.338	31.940	44.109	47.154	54.760
2 3/4	19.457	24.904	32.683	45.135	48.250	56.034
2 13/16	19.899	25.470	33.426	46.161	49.347	57.307
2 7/8	20.341	26.036	34.169	47.187	50.444	58.581
2 15/16	20.783	26.602	34.912	48.213	51.540	59.854
3	21.226	27.168	35.654	49.238	52.637	61.128
3 1/16	21.668	27.734	36.397	50.264	53.733	62.401
3 1/8	22.110	28.300	37.140	51.290	54.830	63.675
3 3/16	22.552	28.866	37.883	52.316	55.927	64.948
3 1/4	22.994	29.432	38.626	53.342	57.023	66.222
3 5/16	23.437	29.998	39.368	54.367	58.120	67.495
3 3/8	23.879	30.564	40.111	55.393	59.216	68.769
3 7/16	24.321	31.130	40.854	56.419	60.313	70.042
3 1/2	24.763	31.696	41.597	57.445	61.410	71.316
3 9/16	25.205	32.262	42.340	58.471	62.506	72.589
3 5/8	25.648	32.828	43.082	59.496	63.603	73.863
3 11/16	26.090	33.394	43.825	60.522	64.700	75.136
3 3/4	26.532	33.960	44.568	61.548	65.796	76.410
3 13/16	26.974	34.526	45.311	62.574	66.893	77.683
3 7/8	27.416	35.092	46.054	63.600	67.989	78.957
3 15/16	27.859	35.658	46.796	64.625	69.086	80.230
4	28.301	36.224	47.539	65.651	70.182	81.504
4 1/16	28.743	36.790	48.282	66.677	71.279	82.777
4 1/8	29.185	37.356	49.025	67.703	72.376	84.051
4 3/16	29.627	37.922	49.768	68.729	73.472	85.324
4 1/4	30.070	38.488	50.510	69.754	74.569	86.598
4 5/16	30.512	39.054	51.253	70.780	75.665	87.871
4 3/8	30.954	39.620	51.996	71.806	76.762	89.145
4 7/16	31.396	40.186	52.739	72.832	77.859	90.418
4 1/2	31.838	40.752	53.482	73.858	78.955	91.692
4 9/16	32.281	41.318	54.224	74.883	80.052	92.965
4 5/8	32.723	41.884	54.967	75.909	81.148	94.239
4 11/16	33.165	42.450	55.710	76.935	82.245	95.512
4 3/4	33.607	43.016	56.453	77.961	83.342	96.786
4 13/16	34.049	43.582	57.195	78.987	84.438	98.059
4 7/8	34.492	44.148	57.938	80.012	85.535	99.333
4 15/16	34.934	44.714	58.681	81.038	86.631	100.606
5	35.376	45.280	59.424	82.064	87.728	101.880
5 1/16	35.818	45.846	60.167	83.090	88.825	103.153
5 1/8	36.260	46.412	60.910	84.116	89.921	104.427
5 3/16	36.703	46.978	61.652	85.141	91.018	105.700
5 1/4	37.145	47.544	62.395	86.167	92.114	106.974
5 5/16	37.587	48.110	63.138	87.193	93.211	108.247
5 3/8	38.029	48.676	63.881	88.219	94.308	109.521
5 7/16	38.471	49.242	64.624	89.245	95.404	110.794
5 1/2	38.914	49.808	65.366	90.270	96.501	112.068
5 9/16	39.356	50.374	66.109	91.296	97.597	113.341
5 5/8	39.798	50.940	66.852	92.322	98.694	114.615
5 11/16	40.240	51.506	67.595	93.348	99.791	115.888
5 3/4	40.682	52.072	68.338	94.374	100.887	117.162
5 13/16	41.125	52.638	69.080	95.399	101.984	118.435
5 7/8	41.567	53.204	69.823	96.425	103.080	119.709
5 15/16	42.09	53.770	70.566	97.451	104.177	120.982
6	42.451	54.336	71.309	98.478	105.274	122.256
6 1/16	42.893	54.902	72.052	99.503	106.370	123.529
6 1/8	43.336	55.468	72.794	100.528	107.467	124.803
6 3/16	43.778	56.034	73.537	101.554	108.563	126.076
6 1/4	44.220	56.600	74.280	102.580	109.660	127.350
6 5/16	44.662	57.166	75.023	103.606	110.757	128.623
6 3/8	45.104	57.732	75.766	104.632	111.853	129.897
6 7/16	45.547	58.298	76.508	105.657	112.950	131.170
6 1/2	45.989	58.864	77.251	106.683	114.046	132.444
6 9/16	46.431	59.430	77.994	107.709	115.143	133.717
6 5/8	46.873	59.996	78.737	108.735	116.240	134.991
6 11/16	47.315	60.562	79.480	109.761	117.336	136.264
6 3/4	47.758	61.128	80.222	110.786	118.433	137.538
6 13/16	48.200	61.694	80.965	111.812	119.529	138.811
6 7/8	48.642	62.260	81.708	112.838	120.626	140.085
6 15/16	49.084	62.826	82.451	113.864	121.723	141.358

To determine the amount of steel needed to blank 1,000 pieces in a single progressive die, multiply the advance of the stock at each stroke by the figure found at the intersection of the two readings on the table. Thus, for stock 0.058 in. thick by $3\frac{3}{16}$ wide, having an advance of 4 in., simply multiply the figure 58.471 by 4 which gives 234 lb., approximately, the weight of steel needed for the 1,000 blanks.

For brass stock multiply by 1.077. Using previous example: $58.471 \times 1.077 = 63$ lb. brass required.

Contributed by Samuel Kauffman

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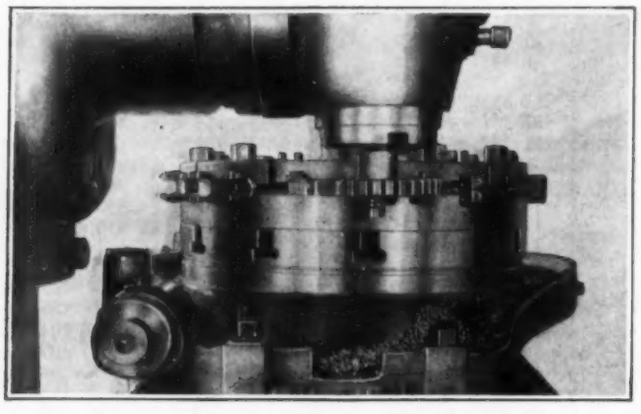
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Continuous Milling Fixture for Injector-Rod Joints

By W. R. Millican

Prior to the use of a continuous-type milling fixture for machining the inside faces of jaws of universal joints for injector rods, the work was clamped in a vise in which one piece was handled at a time. These parts are usually run through in fairly large quantities, so that a continuous fixture is practical, thus enabling the use of production methods.



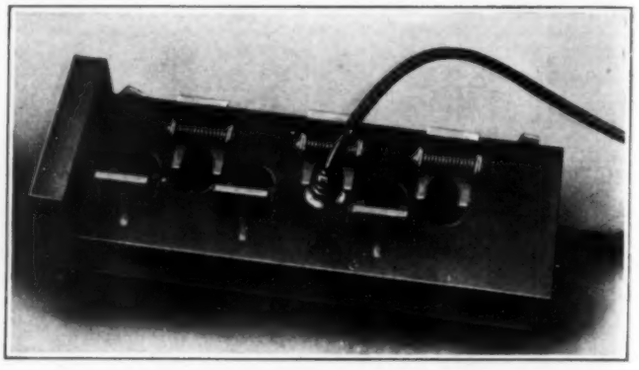
Milling the jaws of injector-rod universal joints

The continuous fixture illustrated, used at the Parsons, Kan., shops of the Missouri-Kansas-Texas Lines, is arranged to hold 16 pieces. It is atached to a rotary table, which in turn is driven by the feed shaft of the machine. The work is held in V-slots located around the periphery of the fixture, and is held in place by clamps arranged to hold two pieces each. The milling cutter is mounted on a sub-arbor secured in the vertical head of the machine.

"Mousetrap" Power Distributing Board

By Frank C. Hudson

The Glenn L. Martin Company, of Cleveland, Ohio, uses a very convenient form of distributing board for portable electric tool connections as shown in the accompanying illustration. It consists of a base made up of two pieces of plank bolted together in the center and carrying six universal sockets that receive the usual pronged plugs. Each socket is provided with a spring actuated clip, which holds the connection in place against any ordinary pull that is likely to take place accidentally. Any pull, however, that might damage the connections or pull the wires lose overcomes the spring resistance,



Power distributing board with spring clips for holding connections in place

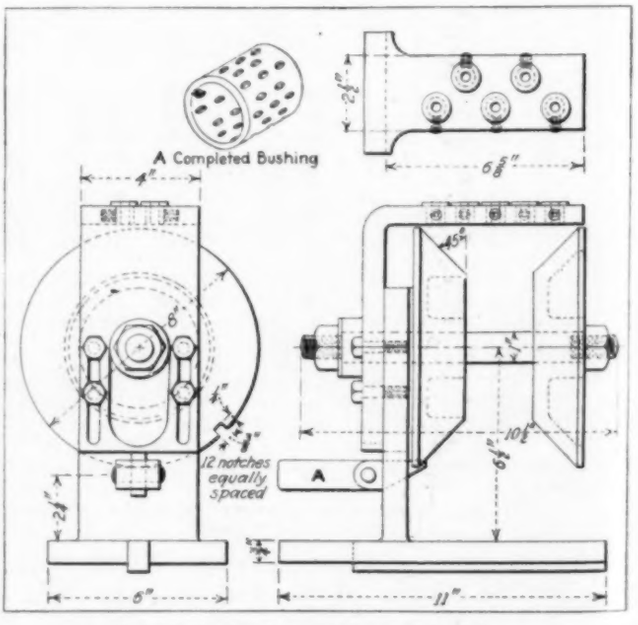
and releases the connection from its respective socket.

These spring clips are simple in design and easily made, the spring action being clearly shown. This form of distributing board has been found very convenient in departments where portable tools are used to any extent.

Jig for Drilling Floating Bushings

By Louis L. Locke

Without the use of some form of jig, the drilling of grease holes in floating bushings of locomotive side and main rods is a rather difficult task. The chief time consumption is in the laying out of the holes. In order to



A drill jig for locomotive rod bushings

simplify the operation, the indexing jig shown in the illustration was made and is in use at the Derby, Me., shops of the Banger & Aroostook Railway.

The bushing to be drilled is held in place by two cone-shaped collars, one of which is adjustable to suit the length of the bushing as well as to permit clamping. Five drill bushings are located in the upper jig plate, thus permitting this number of holes to be completed at one setting. Indexing of the work to the next setting is done by releasing the latch *A*, which engages slots in the periphery of the stationary collar, rotating the work and collars until the latch engages the next slot. There are 12 slots in the collar, so that 12 settings are required to complete the drilling of the bushing.

Used in a drill press equipped with a multiple-spindle head, the jig makes possible the completion of a bushing in from 3 to 4 min., depending upon the size. The same jig, however, can be used in connection with a single-spindle machine.

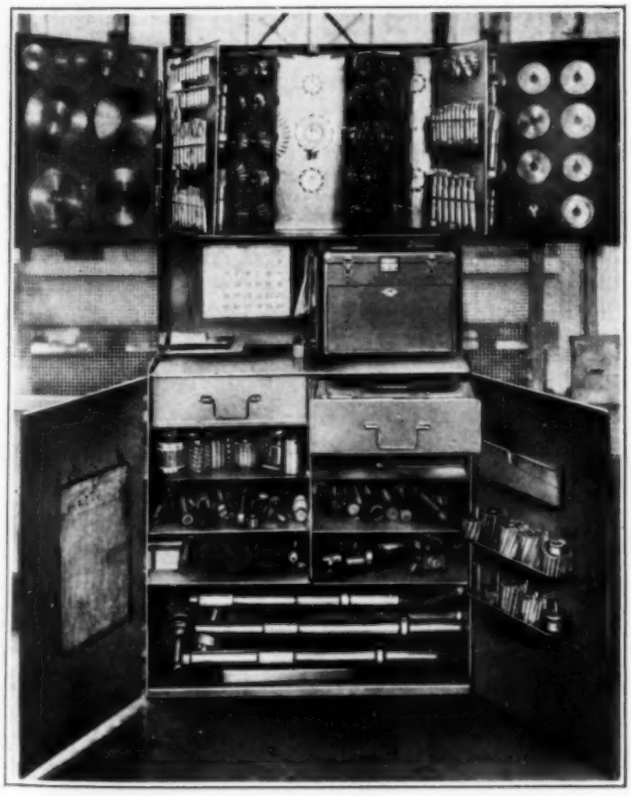
Convenient Cabinet for Milling-Machine Tools

By R. B. Loveland

The illustration shows a convenient type of cabinet for holding milling machine cutters and other tools, which is in use at the Roanoke shops of the Norfolk & Western Railway Company. It is made of $\frac{1}{8}$-in. sheet iron, securely assembled by electric welding. The cabinet is designed primarily for the safe keeping of small tools used in the toolroom, although it can be modified for various other uses.

Racks have been provided in the upper compartment for milling cutters, saws, end mills, keyseating cutters, T-slot cutters and cotter drills. The central section forms a writing desk and a compartment for a tool box.

Two drawers are located in the lower section of the cabinet, being partitioned for hand tools and instruments. Directly under are shelves to accommodate, arbors for face-milling cutters, spring collets, boring heads and various other tools. The bottom shelf of the cabinet has been arranged to hold long arbors. Provision has been made for locking the doors. One of the main purposes of the cabinet is to have a place for everything and everything in its place.

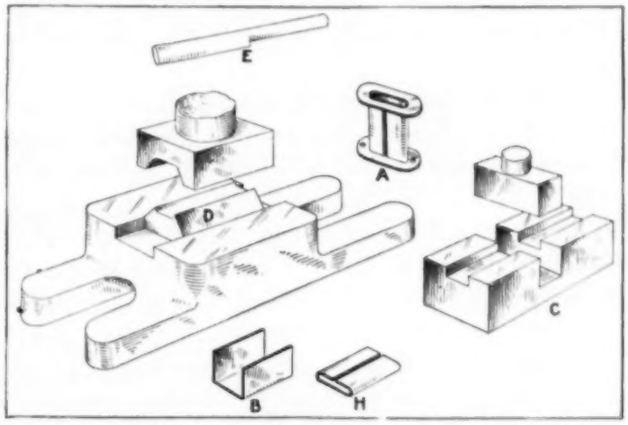


A welded-steel cabinet for the toolroom

Making Spools for Voltmeter Coils

By Chas. H. Willey

In the manufacture of voltmeters for battery testers, it is necessary to provide a spool on which to wind the wire. The spool is composed of three pieces; the core and two flanges, a complete spool being shown at *A* in the illustration. The piece for the core is blanked from



Press tools for forming cores for voltmeter spools

0.010 in. semi-hard brass, and is then bent to the shape shown at *B*, in the die *C*. Three of the pieces are placed end to end in the die *D*, and the mandrel *E* is placed over them. In this die they are formed as shown at *H*, and are easily stripped from the mandrel.

The flanges are blanked and pierced in a very simple progressive die. After the parts have been assembled the flanges are soldered to the core.

Mending-Tissue Instead of Thumbtacks

By J. E. Fenno

One of the troublesome features of tracing from a pencil drawing, is the bulging of the tracing cloth caused by the heads of the thumbtacks used for holding down the paper drawing.

To eliminate this condition, when about to trace, I fasten the four corners of the paper drawing to the board by short lengths of Dennison's mending tisuse, a strip of tissue being located at one side of each thumbtack. The tacks are then removed from the paper drawing and the tracing cloth is tacked in position.

It is evident that by using this method, the tracing cloth will lie flat upon the complete surface of the paper drawing, allowing the pencil lines to be more easily distinguished through the cloth. When the job has been completed, the parts of the tissue adhering to the board can be quickly removed by wetting them with alcohol.

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The New Cutting Tools

MACHINE tool users and builders are both interested in the development of cutting tools. Ever since the advent of Mushet steel, approximately fifty years ago, builders of metal cutting machines have had to redesign and strengthen their machines to meet the demands made possible by better cutting tools. And, though the present day machine tool is a giant in comparison with its predecessors, the end is not yet.

Newer cutting tools are making their way into the shop and still greater strength and more power will be required if these are to be fully utilized. Nor is this merely a question of adding weight in the shape of heavier castings and other parts. For, in spite of power traverse, it is easy to make a machine less flexible where great masses of metal must be moved rapidly. Better materials must be used and more anti-friction bearings seem destined to find their way into machine design.

It is difficult to say how fast the newer cutting materials will come into general use. Their use will depend somewhat on the availability of machines that can utilize them to advantage. This in turn may depend on the demands of users of machines as well as on the builders of machine tools. For higher powered machines must sell for higher prices and the builder cannot sell these machines until the user appreciates their increased value, or is forced by competition to re-equip his plant.

The new cutting tools will, however, force improvements in machine design, and both builders and users of machine tools must give careful consideration to the changes that lie ahead.

The New Responsibility

HALF a dozen employers of labor in one of the big industrial centers made the statement, within the last month and each without knowing what the others would say, that although they were short of men they did not dare advertise for them in other parts of the country. The reason for their hesitancy was that they were sure the present rush was transitory and that they knew they could not provide jobs during the cold months when unemployment may well lead to real hardship.

Here is an attitude that cuts the ground from beneath the feet of the soap-box orator whose main plea is that the employer is interested solely in getting the maximum of work out of a man, only to throw him aside without compunction when his usefulness diminishes. Unfortunately, the old attitude that gave the agitator the basis for his argument persisted far too long in general, and still persists in certain shops where management is unenlightened. But the humanness shown by the men quoted above is significant of the trend today, and an augury of better things in the future.

Navy Day

EVENTS are apparently conspiring to draw attention to naval problems just as the annual Navy Day, October 27, approaches. British and French diplomats get themselves talked about in the daily press for the way in which they handled a cruiser treaty. The Graf Zeppelin arrives in the United States after a not too convincing trip across the Atlantic Ocean. The Goodyear Zeppelin Company starts work on two dirigibles of mammoth size, and an even larger hangar in which to house them. The Republican candidate for the presidency, in a speech at Boston, dwells at some length on the foreign trade situation, the need for a privately owned and profitable merchant marine, and a navy adequate to protect it. There is a great deal of talk both in this country and abroad about what might be accomplished in another international conference to consider further reductions in naval armament. Some of this talk, unfortunately, seems to intimate that the United States shall do most of the reducing, a view that finds little favor in administration circles.

Obviously, the naval problem is not so simple as it once was. Ship classifications are no longer static. What was an adequate speed a few years ago is quite inadequate now. Gun ranges are being increased. Ships must be able to defend themselves from attack in three planes.

It is equally obvious that traditional points of view on naval problems must be abandoned, and that those who cling to them must be educated or eliminated. Navy Day is a good time for thought on such problems and constructive suggestions on how to solve them.

· SHOP · EQUIPMENT · NEWS ·

Hutto Models GA and MGBX Cylinder Grinding Machines

BOTH single- and double-spindle cylinder grinding machines have been placed on the market by the Hutto Engineering Company, 515 Lycaste Ave., Detroit, Mich. Model GA is a single-spindle machine, and is illustrated in Fig. 1. Model MGBX is a double-spindle machine and is shown in Fig. 2. In addition to grinding cylinders, these machines are adapted to the grinding of wrist-pin holes in pistons and connecting rods, as well as various types of bushings. Production for the single-spindle machine is said to be 125 pistons per hour, all within one ten-thousandth of an inch of the required diameter. According to the manufacturer, 600 pistons can be ground with one set of stones.

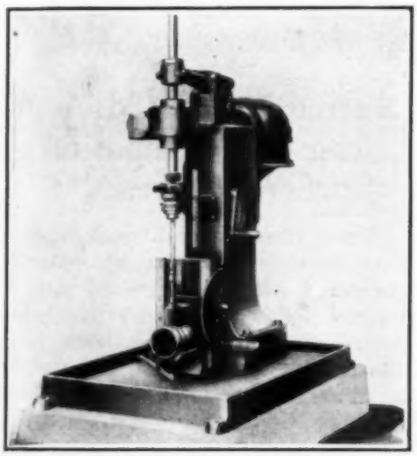


Fig. 1—Hutto Model GA Cylinder Grinder

The Model GA machine embodies a 3-hp. motor, reduction gears and a stroking device which imparts rotating and reciprocating motions to the spindle. The head is supported on a sturdy column.

The Model MGBX machine is a two-spindle unit of the table type, and is used for driving the "BS" and "OS" grinders. A horizontal worm-shaft, housed in the head of the machine pedestal and directly coupled to the electric motor, actuates two worm-gears. The vertical gear near the motor carries an eccentric. A walking beam linked to this eccentric reciprocates the spindle 100 times per min. through the hub of the second gear, which rotates the spindle at 200 r.p.m. The stroke is variable from 0 to 3 in., and power is supplied by a 1-hp. motor.

The switch lever, at the side of the machine, when moved to its extreme position, operates a cam which raises the walking beam and spindle clear of the table for the loading of work. The floor space required is 18x32 in., and the net weight is 253 pounds.

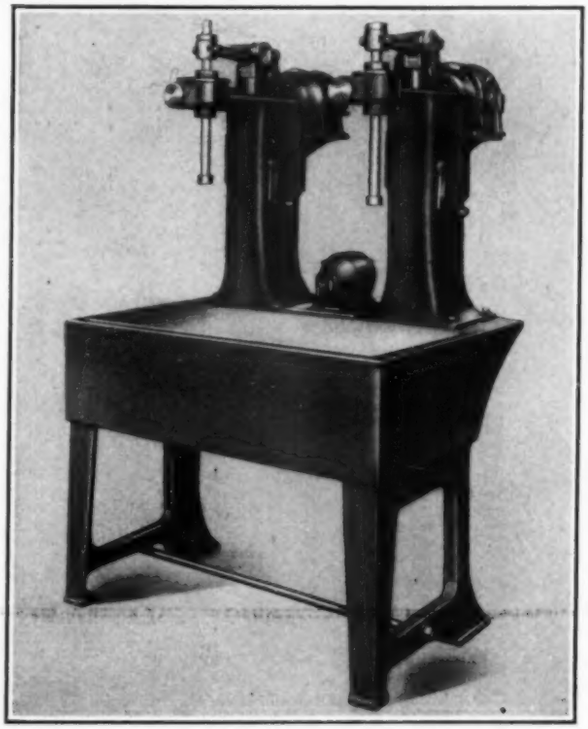
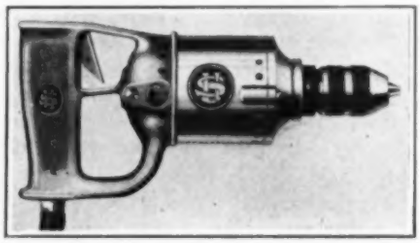


Fig. 2—Hutto Model MGBX Cylinder Grinder

"U. S." Special ¼-Inch Electric Drills

Two special electric drills have been placed on the market by the United States Electrical Tool Company, Cincinnati, Ohio. They are built to operate at 2,000 and 10,000 r.p.m., respectively. The first type has a universal motor for operation on d.c. or a.c., 60 cycles or less. It has an aluminum body, a positive make-and-break switch, and SKF ball bearings throughout. The keyless chuck has capacity for drills from 0 to ¼ in. The dimensions are 10½x2⅞ in., and the net weight is 4⅛ pounds.



"U. S." Special ¼-Inch Drill

The ¼-in. special drill that operates at 10,000 r.p.m. is illustrated. It has a universal motor for operation on d.c. or a.c., 60 cycles or less. Features are the same as for the 2,000-r.p.m. machine. Nickle-steel gears are used. The dimensions are 10½x 2⅞ in., and the net weight is 4 pounds.

Improvements in Norton Type A Grinding Machines

Several improvements have been incorporated in the type A grinding machines manufactured by the Norton Company, Worcester, Mass. They include an integral drum frame and wheelslide, an improved type of pump, steel wheel guards, and ball bearing wheel feed mechanism. All but the ball bearing wheel feed mechanism are so designed that they can be attached in the field to machines already in use. The wheel drum frame has been built heavier to effect rigidity of the wheel head. A heavy idler has been provided which rides the slack side of the belt insuring even tension at all times. Loss of power is further reduced by ball bearings on the idler pulleys and the wheel drum shaft. The wheel guards are made of

steel plate either $\frac{3}{8}$ or $\frac{7}{16}$ in. thick, and formed to shape. The guard is in one piece, and is riveted to a cast steel adaptor. When in place the cover, which is of the same material, has the effect of a C-clamp and provides greater strength in case of wheel breakage. The pump used is less complicated and more accessible than the former arrangement. It is located on the rear base of the machine, below the compound tank. It is driven by a straight belt from the back shaft, and the adjustment of tension is made by two cap screws. This arrangement permits cleaning the tank without removing the pump.

Friction is eliminated in the wheel feed mechanism. Ball bearings have been placed on the feed screw.

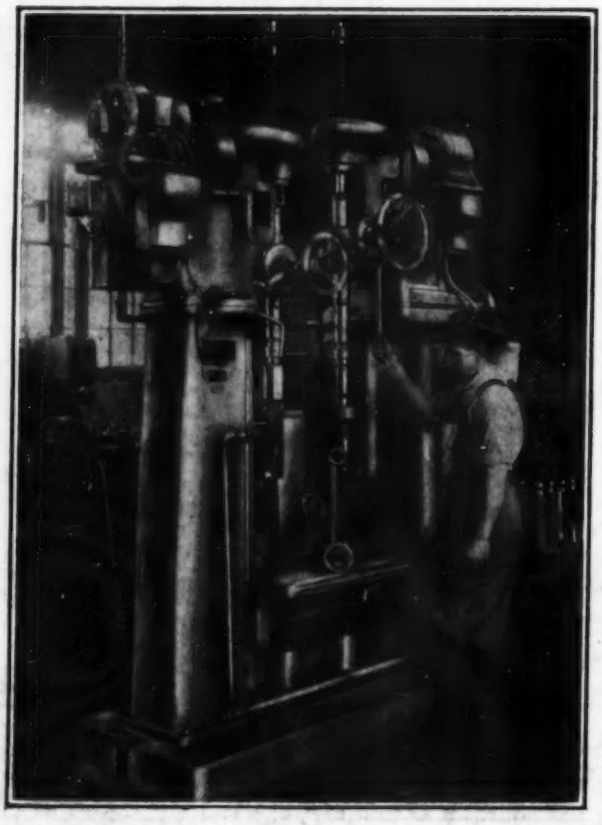
Barnes Special No. 210 Opposed-Spindle Connecting-Rod Drilling Machine

CONNECTING rods may be drilled on the special No. 210 opposed-spindle drilling machine which has been developed by the Barnes Drill Company, 814 Chestnut St., Rockford, Ill. As may be seen in the illustration, the machine consists of two drilling units fastened to a special oil-channel base. Each head has an individual motor, and that to the right is provided with lateral adjustment to accommodate various center distances in the machining of connecting rods.

The work illustrated is a connecting rod having a center distance between holes of $16\frac{1}{2}$ in. The larger hole is bored 4 in. in diam., while the smaller hole is bored 2.150 in. in diam. Both ends are final-finished in this operation, the depth of bore being $2\frac{3}{4}$ in. The same machine takes smaller connecting rods having a center-to-center distance of the holes of 14 in. On the larger connecting rod, a production of one finished piece every $4\frac{1}{2}$ min., with one operator, is obtained. Note that the trip lever control, which is also a starting lever control for both spindles, is placed at the front of the machine. A special table for elevating is provided, and is mounted on the opposite columns for maximum rigidity.

In common with other No. 210 machines, this unit has ball and roller bearings, spur-geared feeds, and is self-oiling. The box columns are of sturdy design and the heads are securely bolted thereon. The heads are units in themselves, containing all the working parts, including the pump for the self-oiling system, with the exception of the coolant pump, which is located inside the column at the base, being driven by a vertical shaft.

Each spindle is provided with six splines, and keys are thus eliminated. The spindles have roller bearings in double rows of short and long rollers. The heat-treated steel crown gears may be quickly exchanged to obtain faster or slower speeds, and the feed trip gears are conveniently located on the right-hand side of the machine. The gearing throughout is of alloy steel and all important gears are heat-treated. Ten radial ball bearings of standard sizes are provided for the gear shaft and crown gears, all being lubricated automatically. Spur gears are used in place of the usual worm and wormgear. Power feeds may be engaged or disengaged when the spindle is running, and an automatic stop giving full spindle travel is provided. A safety device is included to prevent overloading and to minimize breakage of twist drills.



Barnes Special No. 210 Connecting-Rod Drilling Machine

Starrett No. 210 Micrometer for Comparing Screw Threads

Screw threads and work having small grooves or recesses may be compared with the standard size by means of this micrometer which has been placed on the market by the L. S. Starrett Company, Athol, Mass. The anvil and spindle contacts are conical in shape, but are flattened for about $\frac{1}{64}$ in. The micrometer does not measure the actual diameter of a V-thread. It comes in two sizes, the first having a range from 0 to 1 in., and the second from 1 to 2 in. It is also furnished for metric measurements. Larger sizes can be furnished.

Starrett No. 210 Micrometer for Comparing Screw Threads

"Emco" Type W Bench Power Punch Press

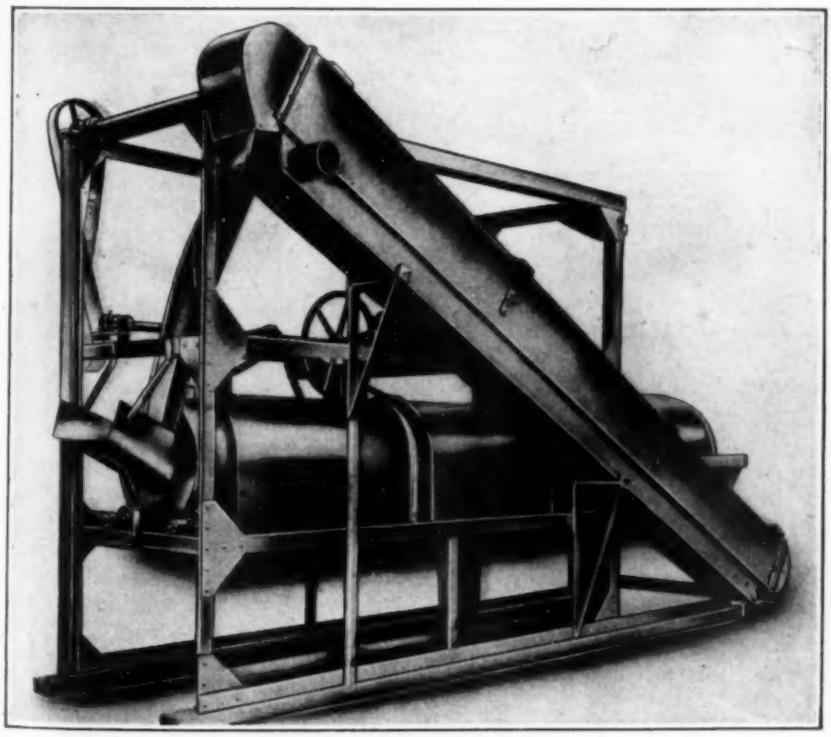
The good will, patents, drawings, patterns, jigs, fixtures, and the rights to manufacture the "Emco" type W bench power punch press, formerly built by the Enterprise Machine Tool Company, Chicago, Ill., have been

acquired by the Cleveland Planer Company, 3148 Superior Ave., N. E., Cleveland, Ohio. It is the intention of the purchaser to build these machines in quantity so that they may be carried in stock for prompt shipment. Repair parts can be furnished.

Ideal Sawdust Drying Machine

In this machine the work and sawdust pass through the drums together. It has been placed on the market by the Ideal Industrial Machinery Company, Division of the Consolidated Concrete Machinery Corporation, Winton Place, Cincinnati, Ohio. The machine illustrated was built for drying oil cans after copper plating and washing. In the last section of the drum, which is perforated, the sawdust is screened out and drops onto the heated drag conveyor to be carried back to the discharge end. There is always a constant stream of hot dry sawdust passing through the machine to clean the work.

On this particular machine heat is also applied to the solid portion of the drum, which is hooded for that purpose. In this way sufficient heat is transmitted to thoroughly dry the work outside as well as inside.

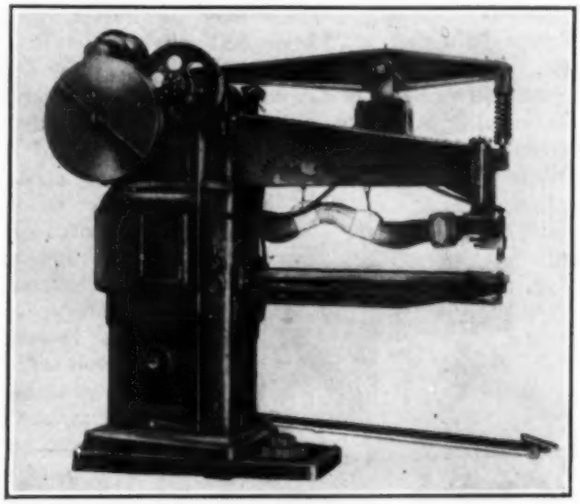


Ideal Sawdust Drying Machine

Thomson No. 75 PA-48 Deep-Throat Power-Driven Welder

LIGHT tanks, smoke stacks, and cylindrical parts made from sheet material up to $\frac{1}{8}$ or $\frac{5}{16}$ in. in thickness can be welded on this deep-throat machine, which has been placed on the market by the Thomson Electric Welding Company, Lynn, Mass. It is known as the model 75 PA-48, and is similar to the model 75 PA welder built by the same company. It has a 48-in. reach, and the lower horn will take care of a minimum diameter cylinder of $8\frac{1}{2}$ in. The welder is suitable for joining a maximum thickness of two pieces of $\frac{1}{4}$-in. material, according to the manufacturer. On cylindrical work of small diameter surrounding the lower horn for any great length, the capacity is cut down by a slight amount.

The deep-throat welder has a transformer of 150-kva. capacity, water-cooled, and is arranged for direct motor drive through spur gears, giving four welding speeds of approximately 21, 27, 37 and 51 cycles per min. These are the same speeds as on the standard 24-in. model 75 PA. The maximum pressure at the die point is 2,000 lb., and this pressure can be adjusted through a spring. The upper die lift which is made by a cam, is approximately $\frac{7}{8}$ in. Greater die opening can be supplied by furnishing a special cam. The lower horn is made of bar and structural steel on which rests the copper current-carrying bus bar. The lower horn has no vertical adjustment. The net weight of the machine is 5,900 pounds.



Thomson No. 75 PA-48 Deep-Throat Power-Driven Welder

Trico Plug Fuses with Colored Tops

Plug fuses with colored tops have been placed on the market by the Trico Fuse Manufacturing Co., Milwaukee, Wis. The colored top, a color for every size, enables the user to know the capacity of the fuse. For example, a 6-amp. fuse has a brown top, while a 10-amp. fuse has a yellow top. Five of these fuses are packed in a carton.

Westinghouse 200-Ampere Motor- and Gas-Engine-Driven Arc Welders

BOTH stationary and portable types of d.c. motor-driven and gas-engine driven arc welders have been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. In Fig. 1 is shown the type "D.C.-D.C." welder, which may be driven by either a 230- or 550-volt d.c. motor. This set is suited to applications where only d.c. is available. In Fig. 2 is shown a gas-engine-driven welder which is driven by a Model P-20 four-cylinder Continental

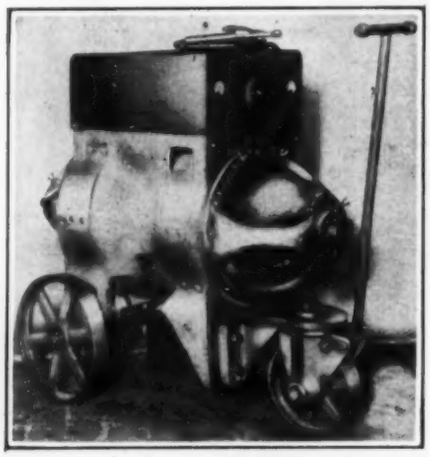


Fig. 1—Westinghouse "D.C.-D.C." Motor-Driven Arc Welding Set of the portable type

engine direct connected to a Westinghouse 200-amp. arc-welding generator. The motor-generator sets have a common frame for both units, and the common shaft is supported by ball bearings. Three roller bearing wheels attached to the frame make the set readily portable, as it is a welder with small overall dimensions and a low center of gravity. For stationary use the running gear may be omitted. The rating of the generator is in accordance with N.E.M.A. standards, being 200 amp. with 1-hour, 50-deg. rise on a resistance load of 25 volts. The welding range is 60 to 300 amp. A special type S.K. driving motor, which is compound wound, maintains constant speed with a voltage fluctuation of not more than 10 per cent. The generator is a single-operator, constant-current, differentially compound-wound type, and is separately excited from the line. The field rheostat of the generator gives a one-dial adjustment for the entire welding range. The control is mounted on the top of the front of the frame, and is protected by a sheet-steel cabinet.

To provide greater compactness, the generator of the gas-engine-driven set has a special bracket which fits into the engine housing. Protective covers over the generator, commutator, and engine head make the equipment waterproof. The engine and generator, complete with all controls, are mounted on an all-welded channel iron base which can be made suitable for either stationery or portable use. The engine is rated at 24 brake hp. at 1,450 r.p.m., which is the generator speed, and will operate under a normal load for 8 hours on 10 gal. of gasoline. A Zenith carburetor with a friction type choke is operated by a positive centrifugal type governor. The lubricating system is pressure fed by a gear type pump. A centrifugal water pump and large radiator provide an efficient cooling system. The generator is the same as on the D.C.—D.C. set.

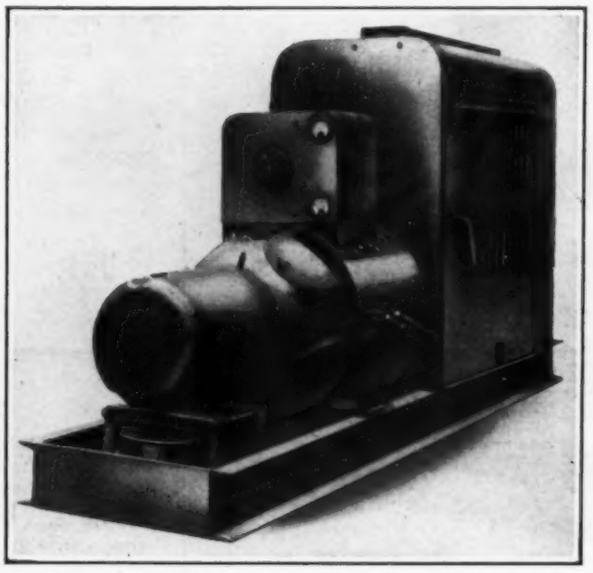
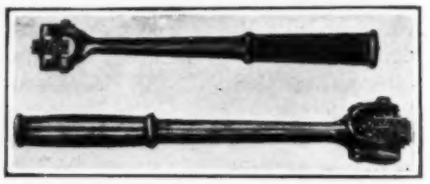


Fig. 2—Westinghouse Gas-Engine-Driven Arc Welding Set of the stationary type

Vincent Special Nos. 0 and 1 Dressers for Grinding Wheels

These dressers are equipped with "Special" bushings with hardened shoulders against which the cutters ride, instead of against the cast iron

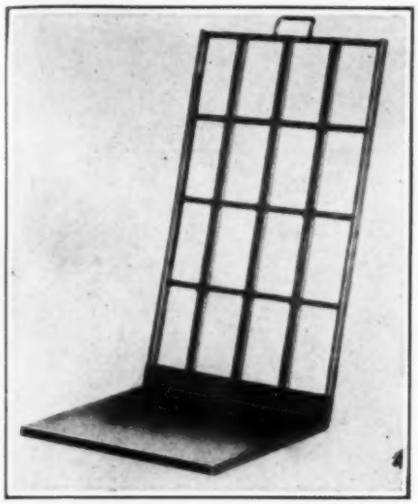


Vincent Nos. 0 and 1 Special Dressers for Grinding Wheels

sides of the handle. They have been placed on the market by the Vincent Steel Process Company, 2519 Bellevue Ave., Detroit, Mich. They are made in both regular and hooded types. The regular type is 11 in. in length and weighs 1¼ lb. The hooded dresser is also 11 in. in length, but weighs 1¾ lb. Any No. 0 Huntington cutter can be used in the No. 0 "Special" dresser. These dressers are packed in individual cartons.

"Tru-Pak" Carrier for Hand Trucks

Flexibility comparable to that supplied by trailers, lift trucks, and skids is given to the ordinary hand truck equipment by the use of this rack which is known as the "Tru-Pak." The carrier, which is built entirely of steel, has been placed on the market by the American Pulley Company, 4200 Wissahickon Ave., Philadelphia, Pa. The deck is of steel plate, as shown in the illustration, and is welded to two steel forgings. These are bent upward and are welded to the inside of the channels that form the back, or upright, of the Tru-Pak. Cross bars are of channel section and the longitudinal straps are flanged to impart greater stiffness. The deck is



"Tru-Pak" Carrier for Hand Trucks

raised far enough above the floor to make room for the truck nose to enter without lifting or disturbing the load.

Tru-Paks permit loading to capacity the miscellaneous parcels that do not lend themselves to stacking on the conventional truck. Bags, cartons, and other light packages have a smooth, flat surface to rest upon and, as a result, are less likely to be broken, ripped, torn, or punctured.

The dimensions are 28 in. wide by 48 in. high. They make this carrier suitable for use with almost every style and size of hand truck. The carrier is proportioned so as to stand upright, either loaded or empty, and to be nested in stacks when not in use.

Oesterlein 28-Inch Tilted Offset Milling Machine

THIS 28-in. tilted offset milling machine, intended for the milling of screws and bolts such as flatting the heads of connecting rod bolts, slotting screws, milling yokes, sawing operations and straddle and face milling of small parts, has been placed on the market by the Oesterlein Machine Company, Cincinnati, Ohio. It is similar in design to the 48-in. machine which was described on page 377, Vol. 67, of the *American Machinist*. The principle of operation is the same, in that relatively large cutters are completely surrounded with work, and the centers of the work and of the cutters are offset from each other to obtain the proper depth of cut. Cutting is continuous, there being no returning to the starting point, and many parts are cut at the same time. The feed decreases automatically in the bottom of the cut. In Fig. 1 the machine is shown in use, while in Fig. 2 the drive is illustrated.

Means are provided in the work-holding fixtures for automatically-clamping, unclamping and ejecting the parts, thereby leaving the operator's entire time for loading. This fixture is illustrated in Fig. 1. Some of the features of the machine are as follows: Provision has been made for the use of 20 gal. of coolant per min., and a large chip basin is provided within the base. Anti-friction bearings are used throughout, including the spindle. The lubrication system, shown in Fig. 3, requires little attention. Heat-treated, multiple-splined gears and shafts are used throughout.

The machine has a table 18 in. in

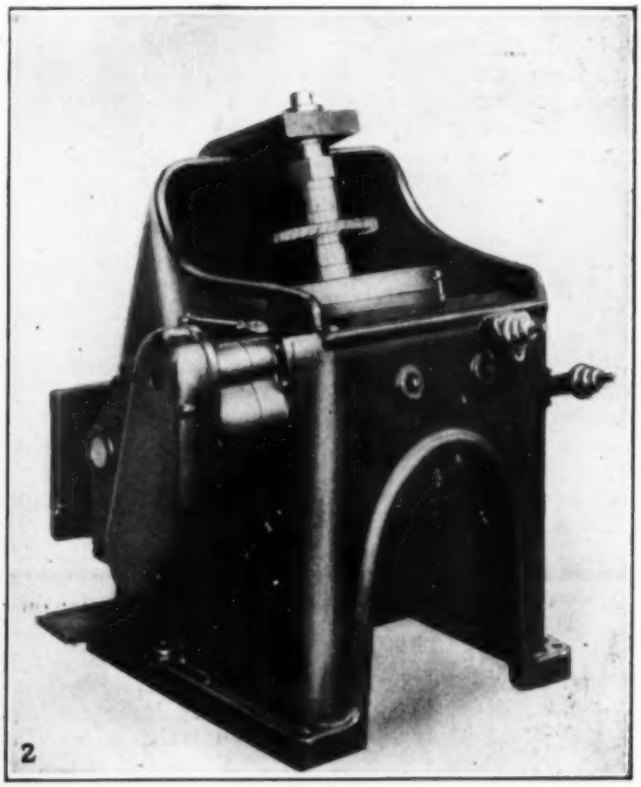


Fig. 1—Oesterlein 28-Inch Tilted Offset Miller with work holding fixture in place. Fig. 2—Showing the drive of the Oesterlein 28-Inch Offset Miller

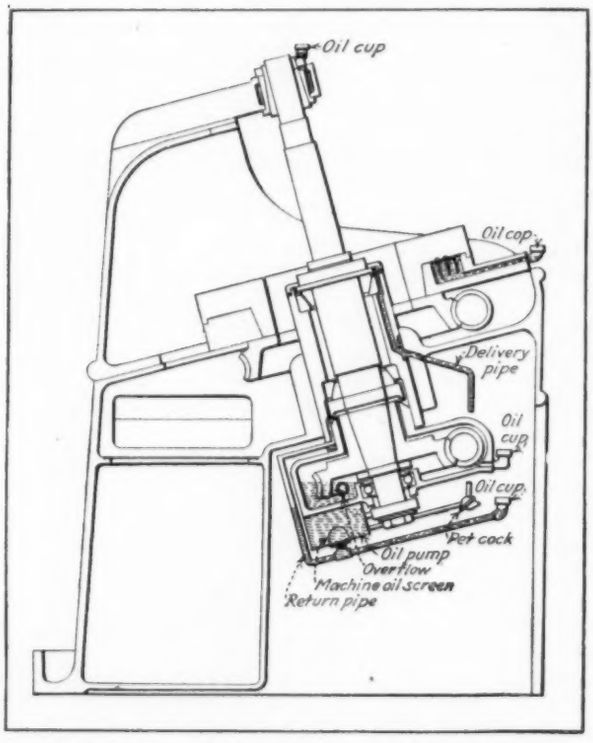


Fig. 3—Lubrication system for the Oesterlein 28-Inch Tilted Offset Miller

diam., and swings work 28 in. in diam., while the distance from the table to the outboard arbor bearing is 14 in. The arbor is 2¾ in. in diam., and is driven by a 3-hp. 1,800 r.p.m. motor mounted on the back of the machine, and connected by a chain to the driving sprocket. The machine weighs 2,600 lb. net.

Blanchard System of Pulsating Lubrication

Lubrication can be fed in the correct number of chops per hour to each individual machine bearing by means of the Blanchard system of pulsating lubrication manufactured by the Rivett Lathe & Grinder Corporation, Boston, Mass. A single oil pipe line is installed, gangs of feeders or dead end branches being taken off at convenient points. Each feeder is adjustable and, when once set, maintains its rate of feed in proportion to the speed of the machine. The pump starts and stops with the machine. As shown in Fig. 1, the unit consists of an oil reservoir containing the circulation pump and pressure control. The pump shaft may be belted or geared to drive at from 75 to 125 r.p.m. in either direction, or reversing. The gage glass shows the amount of oil in the reservoir and the guard rod protects the glass against breakage. A drain plug at the bottom of the deep reservoir is provided. The filler cap is permanently attached, and is swung to one side for filling. When closed, it rests on a curb which keeps dirt from falling into the oil. The filler opening is 1¾ in. in diam., and is provided with a wire screen.

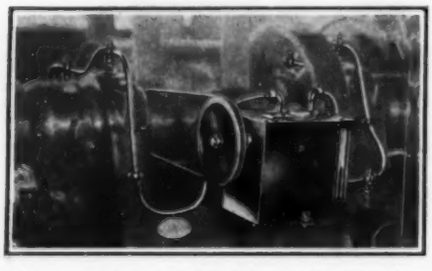


Fig. 1—Blanchard System of Pulsating Lubrication applied to a machine tool

The pump is of the two-cylinder plunger type with piston valves positively driven from the main shaft. The plungers are of steel, ground and lapped to fit. The pump delivers a stream of oil greatly in excess of the requirements of the bearing. This oil makes a complete circuit of the single pipe line, the excess returning to the pressure control valve in the reservoir. The valve is of the rotating-plate type driven by worm and gear from the pump shaft, being closed once in every 15 revolutions of the pump, and remaining closed about 5 per cent of the time. When the valve is open, the oil has free circulation and the pressure is only that required to overcome friction of flow. When the valve is closed, the oil is delivered against a simple pressure-release valve which gives a short pulsation of pressure of sufficient intensity to operate the needles in the feeders.

Connected with the moving parts of the release valve, and located above the cover of the reservoir, is a button which makes a jump at each pulsation. Since this is on the return end of the oil circulation line, it is obvious that this jump or pulsation of the button is a definite and visual indication of the operation of the device. By pressing the flush button down to the cover, the spring in the release valve is heavily loaded and the pulsation pressure is increased about three-fold with a corresponding increase in the amount of oil fed to all the bearings. When the button is released, the pressure is restored automatically to normal and the established feed rates are resumed. This flushing action is advantageous when starting up a machine.

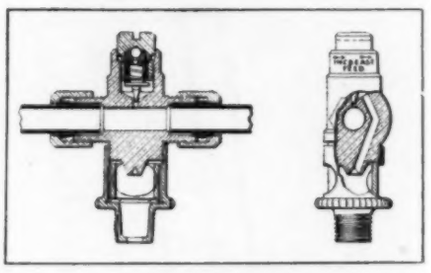
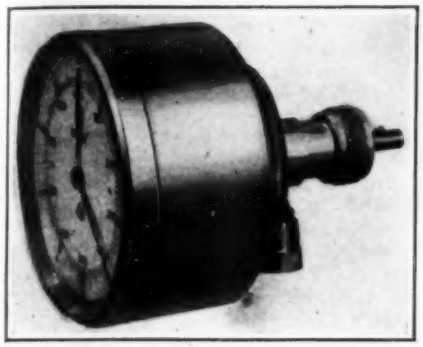


Fig. 2—Cross-sections of the feeder used with the Blanchard System of Pulsating Lubrication

Individual feeders are provided for each lubrication point. They are of various external forms to facilitate application and piping. The main passage to the feeder, Fig. 2, is part of the oil circulation line through which oil flows under low pressure except when the pulsation occurs. This momentary kick acts through a passage to a needle point and lifts the needle from its seat against the adjustable loading of a spring, and admits a particle of oil. Upon the passing of the pulsation, the needle recedes instantly. The oil thus liberated from the circulation line collects in the chamber surrounding the spring and flows down through the bent passage to the end of the nozzle. At this point it is visible through the glass.

Hasler Tel Running Time Meter

THE running time of a machine is registered and totalized accurately and dependably by the Hasler Tel Meter irrespective of the speed of the



Hasler Tel Running Time Meter

machine on which it is installed and of the variation of the direction of rotation, according to the agent in the United States, the R. W. Cramer & Company, Inc., 136 Liberty St., New York, N. Y. The meter is unaffected by vibration, temperature, magnetism, or gravity. It is self-contained and reads like a clock. No charts are required, and neither does it need winding. It can be driven from any rotating member of the machine and registers with equal accuracy in both directions of rotation.

The meter is made in three sizes, calibrated to register respectively, up to 100 hours and repeat, 1,000 hours and repeat, and 10,000 hours and repeat. The first can be read directly to $\frac{1}{5}$ of 1 min. and by estimation to $\frac{1}{2}$ min., the second to within 6 min. and by estimation to within 2 min., and the third directly to 1 hour and by estimation to within 20 minutes.

Lester Improved Die-Casting Machine

AN IMPROVED type of the Lester die-casting machine in four sizes has been announced by the P. & R. Tool Company, Inc., Worcester, Mass. The machine is being built by the Reed-Prentice Corporation of that city. The chief difference from the previous models is in the mechanism providing for the automatic filling of the gooseneck which transfers the metal from the furnace and delivers it to the dies under air pressure. The machine is designed for high production, and is capable of 250 to 300 pieces per hour. Castings are accommodated varying from a fraction of an ounce to 5 lb. in aluminum, and in corresponding weights with other metals.

The machine is semi-automatic in operation, and a 10-hp. motor will operate three machines at maximum production. The die-casting toggle mechanism is operated hydraulically by oil, and with a delivery of 3,000 cu.in. of oil per min. will develop 15 cycles. The operating links are made of cast steel and the machine, which is rigidly constructed, occupies a minimum space because of the short stroke of the cylinder.

Two levers are used to operate the machine from the front, one at the left in a horizontal position and the other vertical. The movement of the horizontal lever brings into action

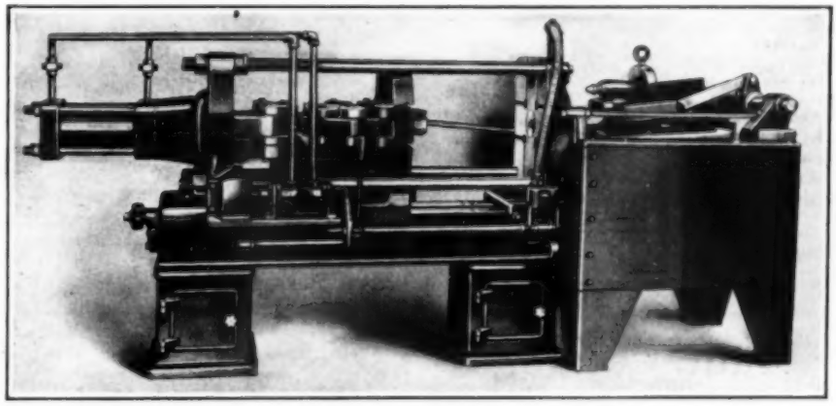


Fig. 1—Lester Die-Casting Machine

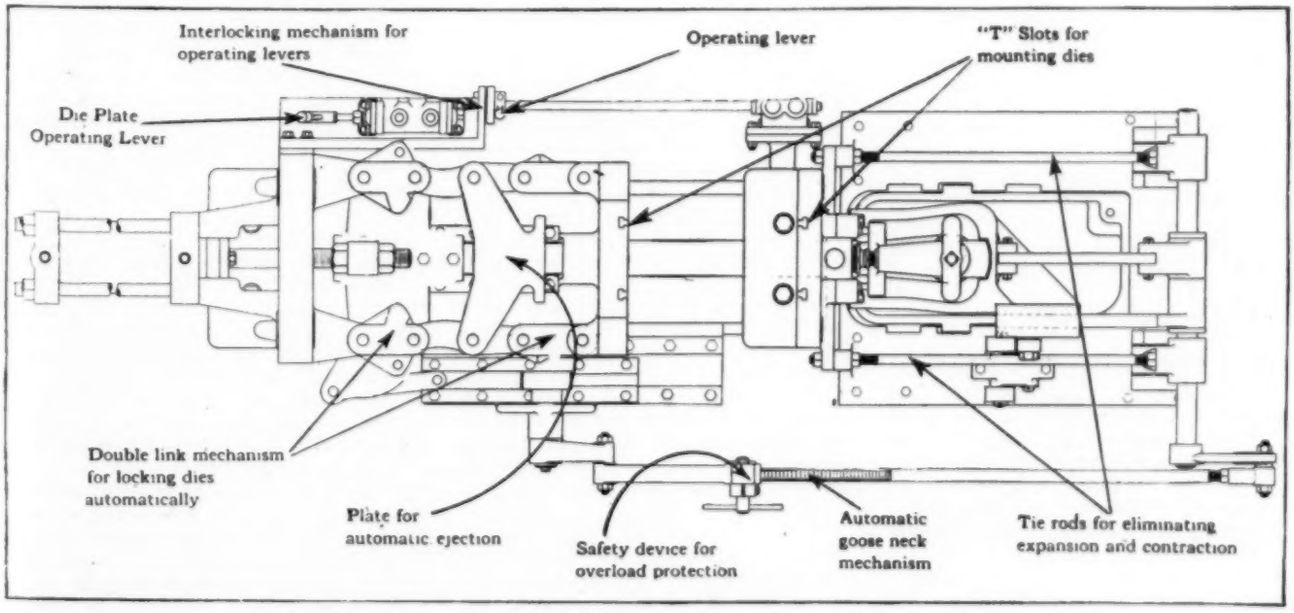

Interlocking mechanism for operating levers
Operating lever
"T" Slots for mounting dies
Die Plate Operating Lever
Double link mechanism for locking dies automatically
Plate for automatic ejection
Safety device for overload protection
Automatic goose neck mechanism
Tie rods for eliminating expansion and contraction

Fig. 2—Diagram of the hydraulic mechanism and links, and also the automatic features

the die closing mechanism and simultaneously the gooseneck is forced into an aperture in the die. The vertical lever provides the air control, forcing the hot metal from the gooseneck into the die to form the casting. The gooseneck is disconnected from the high-pressure line when the dies are open, thus eliminating the danger of accidents. The reverse motion of the vertical lever closes the air line, and the reverse action of the horizontal lever opens the die, the cooled casting being ejected automatically. The dies can be mounted much easier and faster than formerly and the T-slots on the die plates eliminate two wrenches and trouble in locating tap holes in the die from the back plate.

SPECIFICATIONS

	Type			
	7-B	8-A	9-A	10-A
Platen opening, in...	9¼	12	15	20
Maximum die opening, in.....	17	20	22½	34
Minimum die opening, in.....	6	6½	13	16
Between bars, in....	16½x12	20x18	24½x20½	28x21½
Shots per hour.....	250	200	125	75
Length.....	10'8"	12'4"	13'6"	15'9"
Height, in.....	50	53	55	56½
Width, in.....	42	45	47	56
Weight, lbs.....	6,000	8,400	12,000	15,000
Gooseneck capacity, (Aluminum), lbs...	7.5	9.5	11.5	18.5
Pot capacity, (Aluminum), lbs.....	120	180	250	450

Trade Catalogs

FAN-COOLED INDUCTION MOTORS. The Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio, has published bulletin No. 103, showing Type AA Reliance fully-inclosed fan-cooled induction motors with ball bearings for 2- and 3-phase a.c. circuits. The construction of the riveted-frame motors, having blower type fans, and the skeleton-frame motors, having exhaust type fans, are shown by means of photographs and cross-sectional diagrams. Specifications and tables of ratings are given. The pamphlet contains eight 11x8½-in. pages.

GAGES. The Standard Gage Co., Poughkeepsie, N. Y., has published Catalog No. 3, showing several types of gages manufactured, and also the Johansson gage blocks and accessories. The gages manufactured by the above concern are adjustable limit snap gages, limit plug gages, ring gages, master disks, pin gages, and adjustable limit and shoulder plug and snap gages. Several interesting special gages are shown as samples of work that can be developed. The line of Johansson gage blocks and accessories is illustrated and described. Tables and sizes are given for all gages listed in this catalog.

HEAT-TREATING PYROMETER. The Brown Instrument Co., Wayne and Roberts Aves., Philadelphia, Pa., has published a circular entitled "22 Heat-Treating Jobs Using Gas." Views of these jobs together with short descriptions are given. The processes shown include: Annealing, tempering, lead hardening, carburizing, normalizing, calorizing, and galvanizing. The temperatures are controlled by means of the Brown electric pyrometer.

PYROMETER CONTROLLER. The Bristol Co., Waterbury, Conn., has published a leaflet giving the processes for which the Bristol No. 479 pyrometer controller is used. Pictures of several installations are presented. Scales for this instrument can be furnished for various temperature ranges up to 3,000 deg. Fahrenheit.

SAWS. The Huther Bros. Saw Manufacturing Co., Inc., Rochester, N. Y. has published catalog No. 46 showing a line of circular saws, inserted-tooth saws, rip and cross-cut saws and many other types for various woodworking operations. Each type is illustrated and tables of sizes are given. The catalog, which is indexed, contains 103 6½ x 5-in. pages.

SAW SHARPENING. The Norton Co., Worcester, Mass., has published two catalogs on saw sharpening and knife grinding in the Southern and Western saw mills, respectively. Both catalogs give remedies for troubles encountered, together with recommendations as to wheel sizes and grits. Tables of grinding wheel speeds are included in each.

SEMI-STEEL PULLEYS—The W. A. Jones Foundry & Machine Co., 4401 West Roosevelt Road, Chicago, Ill., has published Catalog No. 37, showing a line of "True-Blue" semi-steel pulleys. The pulleys are of solid, split, split-arm and double-arm construction. Tables of sizes on pulleys from 2 to 60 in. in diam. are given. The catalog contains 23 7½x5-in. attractively printed pages.

SHEET-METAL FORMING MACHINES. The Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y., has published circular No. 326 showing a line of sheet-metal forming machinery. Among the types shown are crimpers and beaders, bench machines, slip-roll formers, ring and circle shears, portable punches and groovers.

SIGNAL LANTERNS. The Nichols-Lintern Co., Cleveland, O., has published a 40-page booklet containing complete descriptions of 22 types of N-L universal signal lanterns, together with lantern flasher controls and reflector units for steel mill, factory and highway use. The booklet also contains detailed descriptions of the Lintern electro-magnetic sander for overhead cranes.

TRAMRAIL USES. The Cleveland Electric Tramrail, Div. of the Cleveland Crane & Engineering Co., Wickliffe, O., has published pamphlet TR-632, showing the uses of Cleveland tramrails in the handling of unwieldy loads and objects. Photographs are given showing this tramrail in use in material handling equipment carrying bar stock, rolled wire, and pipe under all sorts of conditions.

WAGE PAYMENT SYSTEM. The Haynes Corporation, National Bank Building, Chicago, Ill., has published a finely printed brochure devoted to the Haynes Manit system of wage payment. The book is illustrated with charts and graphs showing how plants have been able to increase production, decrease unit labor cost, and increase employees' earnings by the use of this system.

Pamphlets Received

IRON AND STEEL SCRAP RECOMMENDATION. The U. S. Department of Commerce, Bureau of Standards, has issued Simplified Practice Recommendation R58-28, entitled "Classification of Iron and Steel Scrap" to cover the program for the elimination of waste through simplified commercial practice. It contains specifications for blast furnace scrap, basic open-hearth furnace scrap, acid open-hearth furnace scrap, electric furnace scrap, grey iron foundry scrap, and Bessemer converter scrap. In addition, the pamphlet contains the contract form for purchase of this material. Conditions in the industry and the history of the subject are cited. The pamphlet may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., for 10 cents.

PATENTS, LAW AND PRACTICE. The author, Oscar A. Geier, is a patent and trademark attorney. He has given the public a concise description of patent law and practice. Starting with a description of the constitutional basis for patents, he proceeds to give a digest of law and practice, procedure in the patent office, and the different kinds of patents. The book concludes with a treatment of foreign patents. Typical schedules of prices for obtaining patents, both in this country and in most foreign countries, are given. The book contains 46 6x9-in. pages. It can be obtained in cloth binding, free upon request, from Richards & Geier, 274 Madison Ave., New York, N. Y.

NEWS OF THE WEEK

German Machinery Exports Record Sound Progress in 1928

Light-weight machine tools dominate machinery exports

BY OUR BERLIN CORRESPONDENT

GERMAN machinery exports in the first half of 1928 evidenced a not overwhelming but thoroughly sound progress. Startling changes one way or the other, which characterized the returns in past years are conspicuously absent. The increase from 213,512 metric tons, valued at 495 million marks in the first half of 1927 to 353,669 metric tons valued at 495 million M. is distributed over almost all the various categories specified in the official statistics. The only exceptions are: steam locomotives, whose export has again diminished, putting the formerly prosperous German locomotive industry into sore straits; cotton spinning machines, and weaving machines—the latter on account of the dropping sales to the United States; mowing machines; cultivators; and rock drills. The most notable increase has taken place in the case of motor tractors and motor plows, whose export in 1925 was still practically nil and has grown to 4,796 units weighing 3,868 metric tons in the first half of 1928. Automotive motors, Diesel motors, and elevators have also increased in export.

INCREASE IN QUALITY

A close scrutiny of the various items shows a decided increase in the quality of the export. Its value is growing faster than the tonnage. In spite of the fact that prices are steadily diminishing, the average price per ton, which in 1926 was 1,770 M. (1,190 M. in 1913) has in 1927 increased to 1,840 M. and in 1928 to 1,950 M. The German machine building industry is now exporting less in weight than in 1913, but decidedly more in value.

The line dividing German machine building into two groups, one whose export business is decidedly progressing as compared with pre-war times, and the other which appears to be straggling behind, has become more distinct in the course of the year. Engineering progress in other countries, political changes and various other handicaps are the obvious causes. To the first-mentioned group belong tractors with steam and motor power, steam turbines, motors for vehicles, Diesel motors, knitting machines, weaving machines, cloth finishing machines, laundry machines, motor plows, mowers, cream separators, paper and wood pulp machinery, pumps refrigerating machinery, elevators, blowers, and leather and shoe machines.

The most prominent of the stragglers are: Railroad engines (3,941 metric tons in January-June 1928 as against 22,794 tons in the corresponding period of 1913); stationary and movable steam engines; stationary combustion motors, other than Diesel motors; sewing machines; wool mills; embroidery machines; woodworking machines; thrashers; agricultural implements, other than mowers; grain mills; and printing machines, except printing presses.

In several of these cases the drop in export business is almost a catastrophy and has resulted in placing the respective branches of machine building into a state of distress.

A fair number of categories are keeping the middle line, having, after some struggling, again reached the pre-war export level. To these belong metal-working machine tools. The accompanying table shows the development of their export in the past years.

Analysis of German Exports of Metal-Working Machine Tools

January–June	Metric Tons	Value, Marks	Units	Av. Price per Ton, Marks	Av. Wgt. per Unit, Kg.
1913	34,849	40,524,000	49,884	1,160	700
1924	16,599	24,426,000	67,354	1,470	245
1926	32,857	49,398,000	51,753	1,500	630
1927	30,586	54,898,000	107,428	1,800	290
1928	34,479	68,255,000	136,873	1,980	260

As can be seen, light-weight machine tool now dominate German exports. The value of the export is at the same time growing steadily. The above figures of 1928 include a reparation supply of 1,174 tons and that of 1927 2,247 tons. The tonnage of the export is almost identical with that of 1913, but its value has nearly trebled.

The increase of the export as compared with 1927 falls almost completely to the share of European countries. Whereas European markets absorbed in past years 72 per cent of the total, this figure is in 1928 80 per cent and signifies a return to pre-war conditions.

Russia is now by far the leader in the list of buyers of German machinery. Adding to the sales to Russia those to Poland and the other pre-war Russian possessions, it appears that the pre-war export is almost reached. In a number of cases the latter has already been surpassed. Most conspicuous is that of Holland, Germany's second largest customer. On the other hand the machinery export to France remains far behind that of pre-war times in spite of the facilities offered by the reparation supply, but the latter is visibly growing. Nearly the same statement may be said of the other of the former German war opponents with the exception of Great Britain. The export to the former Austrian countries is slowly recovering the pre-war value. The deficiency as compared with 1913 has diminished to 12,000 tons. Czechoslovakia having again become a good market for German machinery, almost approaching in absorption power Great Britain and Italy. All in all, the development of exports is steady. Sharp rises and falls, as can be noticed when comparing the above figures, are almost in all cases due to large, exceptional State orders, chiefly for railroad stock.

The consistence of the export to the various countries differs widely, of course. In a number of cases almost all categories of machinery are represented in the export list; in others the market is rather narrowly limited. Among the former are Russia, France, Holland and Switzerland. In the following may be seen what kind of machinery the chief foreign markets mainly buy in Germany.

BELGIUM: Machine tools, textile machines, agricultural implements, elevators

FRANCE: Machine tools, textile machinery, paper mill equipment

GREAT BRITAIN: Machine tools, textile machinery, power generating machinery, machinery for paper mills, printing presses

ITALY: Agricultural implements, machine tools, combustion motors, textile machinery

HOLLAND: Machine tools, pumps, agricultural implements, combustion motors, machinery for building material, elevators, printing presses

RUSSIA: Steam turbines, textile machinery, pumps, machine tools, agricultural implements, paper mill equipment, elevators, ore dressing machinery, machinery for building material

SWITZERLAND: Metal-working machine tools, agricultural implements, printing presses

CZECHOSLOVAKIA: Machine tools, shoe and leather machinery, agricultural implements

ARGENTINE: Combustion motors (Diesel), machine tools, woodworking machinery, elevators

BRAZIL: Wood- and metal-working machine tools, Diesel motors, printing presses.

The reparation supply of machinery is not making noticeable progress. Disregarding the large shipment of railroad engines to Roumania, which has inflated the returns of 1927, the total has remained almost stationary. The supply to France has more than doubled

but other countries dropped out more or less. As a matter of fact, buyers of machinery are not very keen to avail themselves of the facilities of the reparation supply and rather prefer to buy without the lengthy formalities involved by delivery on reparation account.

Measurement Problems Discussed by Engineers

Two papers on measurement were read and discussed at a meeting held in the Engineering Societies Building, New York, October 17, under the joint auspices of the Museums of the Peaceful Arts and the Machine Shop Practice Division of the American Society of Mechanical Engineers. Dr. George K. Burgess, director of the Bureau of Standards, presided after being introduced by Joseph W. Roe, professor of industrial engineering, New York University and representative of the Museums.

The first paper, "Measuring Devices —Primarily Manual," was delivered by James A. Hall, consulting engineer, the Brown & Sharpe Manufacturing Co., and covered the development of hand measuring instruments since earliest historic records. The second, "The Development of Automatic Measuring Devices and the Use of Optical Methods," was presented by Earle Buckingham, associate professor of engineering standards and measurements, Massachusetts Institute of Technology, Cambridge, and analyzed present practice. Both papers will be abstracted in an early issue of the *American Machinist*.

Among those who discussed the papers were J. A. Scheich, Bausch & Lomb Optical Co., Erick Oberg, editor of *Machinery;* Frank O. Hoagland, the Pratt & Whitney Co.; Luther D. Burlingame, the Brown & Sharpe Manufacturing Co.; and D. R. Miller and Dr. Gardiner of the Bureau of Standards. Mr. Miller suggested that judgment on the part of gage operators could be facilitated by setting the limits slightly smaller than necessary: doubtful cases could then be rejected without hesitation.

In connection with the meeting a loan exhibit of measuring instruments was opened at the Museums of Peaceful Arts, 24 W. 40th St. The Pratt & Whitney Co., the Brown & Sharpe Manufacturing Co., John Bath & Sons Co., the Bausch & Lomb Optical Co., the Jones & Lamson Machine Co., the Bureau of Standards and others participated in the exhibit, which will be open for a month, or more.

Progress Shown in the Holland Metal-Working Industry

Notes on the geographical distribution of the industry

By Our Paris Correspondent

THERE is but a single blast furnace operating in Holland on anything approaching a big scale, that of the Vaisen Co. Of the distinct foundry establishments, but two are producing steel castings, those of Baaker & Co., at Ridderkerk, and the Netherlands Steel Works and Keiser & Co., at Utrecht.

Steel construction plants and forges number around 40, chiefly centered at Utrecht, Amsterdam, Rotterdam and Haarlem. In 1926 there were employed nearly 5,000 workers, producing an output valued at approximately 7 million dollars.

Machinery plants number, big and little, in the neighborhood of a hundred, located principally at Rotterdam, Schiedam, Utrecht, Haarlem, Enschede and Hengelo. They employ around 18,000 workmen and produced last year a volume valued at approximately 28 million dollars with an additional 3 million dollars in various sorts of rolling stock.

The shipbuilding industry is important. There are well over a hundred establishments operating 150 distinct plants of various sorts, chiefly at Rotterdam, Dordrecht, Flushing and Amsterdam and along the north coast, giving employment to 30,000 workers. Their output is valued at approximately 50 million dollars.

Rotterdam and the cities along the River Maas, from Dordrecht to the sea, are the chief centers of the metal-working industries drawing their raw and semi-raw metallurgical products chiefly from Belgium and Germany, by the Rhine and other waterways. Both Belgian and German imports into Holland benefit of at least 40 cents a ton on the score of transportation charges alone on such products. From Rotterdam, their chief *entrepôt*, distribution is usually by canal to the most important fabricating and consuming centers, of which an important development is recently to be noted in the region east of Amsterdam approaching the German frontier.

Imports of metal goods, consist chiefly of reservoirs, rails, axles, iron, steel and copper wire, oiling and greasing appliances, joints and tubes, small tools and machinery for woodworking and metal-working and accessory parts thereof, and are largely from Germany and Belgium.

In 1927 the import from Germany of such articles was three times that from Belgium, the former being valued at $35,000,000 and the latter at approximately $12,000,000. Like French exports to Holland the same year scarcely reached 3 million dollars in value, on the other hand.

Plans Maturing for Western Metal Congress

Already 30,000 sq.ft. of floor space has been allotted to exhibitors in the Western States Metal and Machinery Exposition to be held in connection with the Western Metal Congress and the semi-annual meeting of the American Society for Steel Treating in Los Angeles, January 14-18, 1929. At the same time, Western sections of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Petroleum Institute, the American Welding Society, the Society of Automotive Engineers, the Metal Trades and Manufacturers Association, the National Purchasing Agents Association, and several other bodies, will participate in the presentation of papers.

For Eastern visitors a special train is to leave Chicago, January 7, on the Santa Fe R.R., making a one-day stop at the Grand Canyon en route. The exposition will represent a complete cycle of the metal industry from the raw material to the finished product.

Technical Papers

Some of the papers already scheduled include: "Electro-Plating and the Uses of Copper in Machinery," by an engineer of the Anaconda Copper Co.; "Heat-Treatment of Gears," by W. H. Phillips, former chief engineer, R. D. Nuttall Co.; "Bearing Metals," by Mr. West, of Pike & West, San Francisco; "Manufacture and Heat-Treatment of Automobile Leaf Springs," by J. B. Rauen, general manager, U. S. Spring Co., Los Angeles; "Production of Nickel Steel Castings by the Electric Furnace Method," by E. Favary, consulting engineer, Moreland Truck Co.; "Aluminum," by Dr. Zay Jeffries, chief research engineer, Aluminum Co. of America; "Heat-Treatment with Oxy-Acetylene Flame," by J. J. Bruton, service engineer, Oxweld Acetylene Co.; "Investigation of Fatigue Resistance of Eutectoid Carbon Steel When Drawn at Different Temperatures," by Mr. Watson, Regan Forge & Engineering Co., San Pedro, Calif.; "Nickel-Chrome Alloy Iron," by an engineer of the Bethlehem Steel Co.; "Importance of Shops in University Training," by A. B. Domonske, mechanical engineering department, Stanford University; "Heat-Treatment of Carbon and Alloy Steel Castings," by J. E. Donnellan, chairman of Foundry Division of the American Society for Testing Materials. There will also be papers on heat-treating furnace design, gas versus electricity for such furnaces, existing heat-treating installations, and on what the gas companies are doing to help the steel treaters, arranged by the Pacific Coast Gas Association.

The American Society of Mechanical Engineers has arranged for a symposium of four papers on the manufacture of oil country specialties to include: Tool joints; cast-steel slush pump cylinders; Kelleys, or grief stems.

pump cylinders; Kelleys, or grief stems, and sucker rods. These four papers will touch briefly upon the service to which the units are subjected, the raw material used, the physical properties, the forging and heat-treating, and gaging and control of production.

Machinery Associations to Meet at Washington

Through the Trade Association Department of the Chamber of Commerce of the United States, a conference of machinery and equipment associations has been called for Thursday, November 8, at the U. S. Chamber of Commerce Bldg., Washington, D. C., to discuss the following subjects: Free engineering service, unlimited maintenance service, unfair competition practices, unknown cost of doing business, obsolescence, and the reasonable period to hold patterns. W. H. Rastall, chief of the industrial machinery division of the Burerau of Foreign and Domestic Commerce, and H. C. Dunn, domestic commerce division, Department of Commerce, will outline further possible subjects for discussion. This conference is the outgrowth of an earlier conference held at Montauk Point, Long Island, N. Y., on September 29 at which fifteen representatives of the machinery industry were present. E. F. DuBrul is chairman of the conference and Philip Gott, secretary.

Gray Iron Institute to Meet

The first annual meeting of the Gray Iron Institute is to take place on November 14 at the Cleveland Chamber of Commerce rooms, Terminal Tower Bldg., Cleveland. At the meeting, directors will be elected for the ensuing year and certain policies determined upon. Seventy gray iron foundries are now represented in the association.

Billings & Spencer to Reorganize Finances

A plan for the reorganization of the Billings & Spencer Co., Hartford, Conn., was adopted on October 16 by the board of directors, the protective committee for the two classes of stock and the banks and bankers holding notes.

David J. Post was elected chairman of the board and A. H. Deute, vice-president and general manager. Frederic C. Billings remains as president and treasurer. The new board consists of Mr. Post, Mr. Billings, Mr. Deute, Richard J. Goodman, Edward Milligan, Lucius F. Robinson, Nelson Smith and L. Edmund Zacher. A special meeting of the stockholders will be held at the plant on Laurel Street on November 19 to take further action, particularly in reference to new stock distribution.

The approved plan is the result of extended study and negotiation and seeks to conserve and promote the interests of the company's stockholders and creditors and to establish the company's business on a strong financial basis. The company's present liabilities include $550,000 of 7 per cent mortgage bonds secured by trust deed of all the company's real estate, plant and equipment, and unsecured short term notes held by local banks and bankers in the aggregate amount of $672,500. The reorganization contemplates the entire wiping out of the company's bonded and note indebtedness and a substantial increase in its working capital.

At present the company has a working force of about 500 men, and is engaged in three operations: making drop-forged wrenches, drop hammers, and general jobbing forging work. The company dates back to 1869, when Charles E. Billings and some associates formed the Roper Sporting Arms Co. and the name was changed to the present title in 1870. Its present location is the former plant of the Maxwell Motor Company.

Metallurgy Subject of Meeting at Carnegie Institute

THE Metallurgical Advisory Board to the Carnegie Institute of Technology and the United States Bureau of Mines, held its annual meeting Friday, October 19, at Pittsburgh. This board meeting is the second which has been opened to those interested in metallurgical research. The interest shown by the metallurgists in attendance will probably prompt the board to hold further open meetings in the future.

The address of welcome was made by T. D. Lynch, retiring chairman of the board, and consulting metallurgical engineer for the Westinghouse Electric & Manufacturing Co. The morning session was occupied as follows: Illustrated report on Case Carburizing Research, by Dr. V. N. Krivobok, associate, Bureau of Metallurgical Research, Carnegie Institute of Technology; followed by discussion by Dr. C. H. Herty, Jr., physical chemist, U. S. Bureau of Mines, Dr. H. W. Gillett, Chief, Div. of Met., U. S. Bur. of Stds., and M. A. Grossman, metallurgist, Central Alloy Steel Corporation, and others.

Doctor Krivobok states that abnormality cannot be eliminated by heat-treatment. The work is being conducted with carefully prepared iron-carbon, iron-manganese, and other alloys, thus reducing the number of variables. In the discussion Dr. Herty stated that high oxygen and fine inclusions give abnormal case structures, that the oxygen is not present as iron-oxide, and that up to 0.8 per cent silicon or 0.5 per cent carbon, the abnormality is not affected.

Following the case carburizing report came the progress report of Dr. F. M. Walters, Jr., director, Bureau of Metallurgical Research, Carnegie Institute of Technology; a discussion of the application of X-rays to the study of metals, by Dr. J. B. Friauff, associate of the same bureau; report by Dr. V. N. Krivobok on metallurgical work, and on iron-manganese alloys; and a discussion in which Dr. H. W. Gillett, Dr. Zay Jeffries, consultant metallurgist for the Aluminum Co. of America, General Electric Co. and National Tube Co., Prof. Bradley Stoughton of the department of metallurgy at Lehigh University, A. V. DeForest, research engineer of the American Chain Co., and others, took part.

Luncheon was served in the offices of President Thomas S. Boker of the Carnegie Institute of Technology. A. C. Fieldner, chief engineer of the experiment stations division of the U. S. Bureau of Mines, Washington, D. C., in opening the afternoon technical session, emphasized the fact that the close contact in Pittsburgh between the bureau and the steel mills results almost immediately in large scale application of the results.

Dr. C. H. Herty, physical chemist of the Bureau of Mines, gave an illustrated progress report on fundamental studies in the laboratory, and a report on plant research in the open hearth. The first report was followed by discussion by Dr. John Johnston, director, department of research and technology, United States Steel Corporation; A. L. Field, metallurgical engineer, Union Carbide and Carbon Research Laboratories; John Astor, of the department of mining and metallurgy, Carnegie Institute of Technology; and Dr. D. F. McFarland, department of metallurgy, Pennsylvania State College. The second report was followed by discussion by C. L. Kinney, director, physical laboratory, Illinois Steel Co., L. F. Reinarty, assistant general superintendent, American Rolling Mill Co., and W. J. Ballantyne, superintendent of open hearths, Jones & Laughlin Steel Corporation. The work of Dr. Herty seems certain to result in an improved knowledge of steel making and in cleaner and more uniform steels for the user.

Speller Elected Chairman

At the annual business meeting F. N. Speller, chief metallurgical engineer, National Tube Co., was elected chairman of the advisory board for a term of three years, and G. A. Reinhardt, chief metallurgist, Youngstown Sheet & Tube Co., vice-chairman. Dr. W. H. Hatfield, director of research at the Brown-Firth Research Laboratories, England, gave the main address of the evening, particularly praising the fundamental research work going on at Pittsburgh and predicting that the work of Dr. Herty would some day be considered classical. Scott Turner, director of research, U. S. Bureau of Mines, spoke on "Looking Ahead," and announced a larger research budget for the year.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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AN ADVANCE in commodities, particularly the agricultural staples, is about the only movement that is required to round out the symphony of American prosperity whose earlier melodies have been so long audible in Wall Street and the stock market. Some intimations that this final movement is in course of preparation, and would soon be heard, are to be found in the strength shown by the cotton and grain markets last week, as well as in rubber, sugar and silk, where some bullish overtones are also to be discerned by those whose ears are attuned to the harmonies and discords of speculation.

It may be that it is a mistake to assume that the consumable things which society requires must rise because investment securities and real estate have gone up. It is, nevertheless, an assumption that is warranted by precedent as well as by logic, and it seems unlikely that the bull movement can much longer be confined to the Stock Exchange and its tributary markets.

The improbability of this limitation seems to be dawning upon many merchants who have been buying from hand to mouth until recently, and they are now finding it somewhat difficult to get their larger orders filled. Hence full prices are being paid for goods that are urgently needed, and, as stocks are admittedly small, it is not surprising to read that "hectic efforts to get orders filled" are being made in some departments of the cotton goods trade. This is a partial explanation of the advance in raw cotton, which has also been helped by lower crop estimates and a fear that the next government report would indicate a still further reduction in the yield.

In grain, and especially in wheat, the better feeling is ascribed to an improved export demand. In rubber, the strength has been directly due to the immense production of automobiles.

If any further explanation of the strength in the merchandise markets is needed, it may be found in industry, where labor is fully employed, and most manufacturers are running well up to capacity. In steel, the output for the year promises to exceed all previous records, and the same thing is true of the automobile industry. The building trade is also getting to be very busy, and the present prospect is that many of our city streets will be turned into canyons unless some limit is imposed upon the height of the sky scrapers that are becoming so numerous everywhere.

The shoe industry, the lumber industry, the furniture industry, and almost every other form of manufacturing activity are also well employed, and if the off-take continues to absorb the output, there can be no ground for complaint. And last, but not least, there is the stock market, which continues ebullient in the confident hope that money will soon be easier, and is kept active by the consolidations that are being announced; the stock dividends that are being declared; and the creation of new investment trusts.

One of the latter, brought out last week, has a capital of $15,000,000, which is said to have been subscribed three times over, and it is rumored that a prominent system of chain banks will soon pass into the control of a holding company, capitalized at $250,000,000.

A Stock Exchange seat has sold at $480,000, and the financial imagination is so excited that the most absurd rumors and tips find ready credence. Of course, all this is feverish and unhealthy, but every fever has to run its course, and there is nothing in sight that indicates an early drop in the temperature of Wall Street.

In other presidential campaigns, a political scare has usually occurred in October, but business men seem to have no fear of this year's election; and those who are apprehensive of the present situation must look in some other direction to find warrant for their misgivings. But they will have to look hard to find anything seriously out of joint, and while caution is always to be commended, it must be admitted that the much talked of "brokers' loans" is about the only feature of the present situation that need give any concern. The subject is a hackneyed one, and the public mind has become somewhat indurated to its implications, but the continued increase in the proportion of American bank resources that is employed in carrying securities is a serious matter, and some way to deal with it must be found.

With this single and important exception, the outlook in the United States seems entirely satisfactory, and in Europe conditions are also promising, although the prosperity overseas has not kept pace with the activity that prevails here. Great Britain is plainly on the mend, and a continuous improvement is reported in most of the continental countries that are economically important.

One of the most significant and gratifying developments of the week is an arrangement between the General Electric Company and the Amtorg Company, in pursuance of which the former will sell electrical equipment in Russia through the latter organization. There are many who believe that this means the illumination of Russia, both literally and figuratively, and it will certainly open up an important field to American enterprise and industry.

WHAT'S DOING IN INDUSTRY

THERE are at present two noticeable conditions in the machine tool industry that may be considered indices of its present state: one is the fact that there is a shortage of skilled workers; the other, that deliveries are becoming difficult and hence embarrassing to local dealers and representatives. In many cases night shifts are in order, and at this date few deliveries can be promised until after the first of the year.

THE index of machine tool orders, compiled by the National Machine Tool Builders' Association, showed for September the highest figure since March, 1920. As far as deliveries go, the automotive industry has been most insistent and is naturally receiving attention due to its importance to the trade.

AUTOMOTIVE shop buying leads in Detroit, of course. It also leads in Milwaukee and in Cleveland. In Chicago, tractor shop buying is an important factor, while in the East aeronautical activities are attracting attention, particularly in New England and New York.

ASIDE from these related industries, general industrial buying continues at a good pace in the aggregate, with no particular outstanding orders. New heavy machinery is not going well, but sales of second-hand heavy equipment are at a high level, the best for some time. The railroad situation, which has been dull for some time, is beginning to look up, with the large inquiry of the Norfolk & Western the predominant feature.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHICAGO

The demand for machine tools shows no sign of recession. With respect to the volume of trade reported by the leading machinery houses and manufacturers' representatives, an increase over September's business is more the rule than the exception. Such slight falling off as was indicated during the first week in October has more than been made up by orders received since. This applies to almost every type of equipment, but especially so to milling machines, shapers, planers, automatic screw machines and punch presses. One of the leading manufacturers of millers in the Midwest is reported to be far behind in deliveries, all new orders being booked without guarantee as to delivery date.

Tractor plants still are important factors in the market. Industrial concerns are buying freely. No developments are reported as to new railroad lists, and none are looked for much before the early part of 1929. The inquiries coming in are for machinery of all types, and are of a nature such as to practically insure high-pressure business at least for the remaining months of this year. Dealers in used tools report trade on a good level, with increased demand for machine tools of heavy-duty types.

PHILADELPHIA

Machinery and machine tool dealers and manufacturers in the Philadelphia area reported business to be on a substantial foundation with inquiries supporting their hope for continued activity and with a volume of orders that indicates the industry is on the up-grade.

Textile mills, steel companies and one truck manufacturing concern have purchased cutting and grinding equipment in the Philadelphia market during the last two weeks. Added to this were a number of moderately large orders from general industrial lines from a well scattered area. The automobile trade has made some inquiries for shop equipment and there have been some orders for used machinery which the dealers say came from substantial sources.

There has been little or no buying of heavy machine tools for railroad shops, and dealers and producers of that line do not have as hopeful an outlook on the situation as others.

CINCINNATI

Taking the industry as a whole, the machine tool manufacturers of the Cincinnati district booked an increased volume of business in the past week. Reports vary, however, about half of the concerns reporting a gain and about half reporting that sales were approximately at the same level as in the previous week. An improved market tone is reported by executives of the great majority of the concerns, who express the opinion that the trade pendulum will continue its upward swing.

Selling agents report that in the week their business improved to an appreciable extent in local and adjacent territory. Sales resistance is showing a tendency to lessen, it is stated, and there is less lapsed time than there has been between the receiving of the inquiries and the closing of the orders.

The great majority of the week's orders called for single tools and replacements, but here and there was an order for two or three tools. The great majority of the buyers were general machinists and miscellaneous users, located in all sections of the country, and their orders were well diversified. An increased amount of buying was done by concerns in the automotive industry and its allied trades, the great majority of the orders calling for single tools.

Inquiries held up well during the week, both the manufacturers and the selling agents report, the major portion of them coming from general machinists and miscellaneous users and calling for single items. Inquiries from the railroads and the automotive field and its allied trades were largely confined to single tools, for replacement purposes.

CLEVELAND

Sales of machine tools continued on a fairly even level during the past ten days. A few dealers report slight declines, while on the other hand reports were obtained of increased sales. Buying is confined to one and two pieces with a substantial aggregate. Inquiries are holding up well compared with the last ten days. A steady improvement is also noted in the sale of woodworking machinery.

The class of business represented in purchases made included the automotive industry, airplanes, tractors, metal-working trades, oil tool shops, tool and die shops, general machinists and foundries. Overtime schedules are being used to rush through to completion the business on hand in anticipation of future orders. Production is somewhat hampered by the scarcity of skilled machine workers.

The Hydraulic Pressed Steel Division of the Truscon Steel Co. has been awarded a contract for the largest number of automobile step hangers ever placed. The division has also received a year's contract for frames for the Graham Paige Motor Car Co., of Detroit.

Sales of twist drills are well above the normal at this season.

There is no question in the minds of the trade that the remainder of the year will continue to be active. Present indications are that 1928 will be one of the good years.

NEW ENGLAND

The machinery market registered no changes of outstanding importance during the past week in the New England territory, and business functions at an encouraging level. Orders for machine tools and machinery are being placed with comfortable regularity with lists for the smaller units predominating. Inquiries are being received in good numbers from a variety of manufactories.

Large pig iron orders have been placed by Connecticut valve makers, indicating a promising factor for improvement in this industry. While full schedules are now in force it was only recently that this industry had a number of plants on four-day schedules. The Fafnir Bearing Co., New Britain, is making a new shackle bearing, already a standard part going into Studebaker motor cars, from which large orders are anticipated.

Expansion in the aeronautical field is very much an outstanding feature of New England industry. The Farrel Foundry Co., Derby, Conn., has started casting for shop equipment for a Naugatuck airplane plant. Two other plants in Naugatuck are preparing for production, including the Kimball Aircraft Corporation which is to make 135-hp. air-cooled radial engines, and also four-cylinder, double-opposed 75-hp. air-cooled motors. The Moth Aircraft Corporation is anticipating for production of small two-seater Moth planes in the Rauch & Long plant at Willimansett, Mass. Actual assembling is planned in two months. At Norwalk, Conn., the Fairfield Flying Service, Inc., has been organized to manufacture planes.

MILWAUKEE

Optimism of a well grounded nature rules the metal-working equipment trade. Sales of new equipment continue at a rate that give no relief to the concern of manufacturers with respect to their ability to turn out machines at a rate that will enable them to place orders in the hands of customers within the limits specified for delivery. It is not a flood of orders, but rather the insistence of buyers upon quick delivery that is the most serious problem, although the volume of new business developing is of a substantial character. In the effort to make deliveries as requested, makers of equipment continue to be checkmated by an acute shortage of skilled labor, particularly with respect to shops that institute night shifts.

While new business comes from very widely distributed sources, testifying to the soundness of the situation, it probably is the passenger automobile industry that is responsible for the most vexatious problem of deliveries. This industry is enjoying comparatively brisk business and is attempting to meet demands in a most energetic manner, causing pressure upon the tool industry such as has not been experienced in several years, perhaps not since the War. To guard against overexpansion, and with the restrictions of a labor shortage a limiting factor, not much effort is being made to enlarge plant facilities. It would appear, from all indications, that existing facilities will be kept busy at utmost capacity until after Jan. 1. In fact, this would probably be necessary, in most shops, if no new business appeared from now until that time.

Employment reports say that the gain in number of employees in Milwaukee industries has been practically continuous since the middle of the year and factory employment shows a substantial excess over the summer and fall months of last year. September employment was 450 more than in August, and 1,960 greater than in September, 1927. The demand for help in the metal and building trades divisions exceeded the supply, and the condition has not abated.

DETROIT

The machinery and machine tool market in Detroit is maintaining an even level and thus far in October gives every indication that the month will be at least as good as September.

Almost all of the automobile plants, the body plants and the manufacturers of accessories of all kinds are in the market for something. There is still a good demand for large machinery of one kind or another but most of the orders are for tools and small equipment. All of the shops are doing well and though none of the orders are very large the general condition of the business seems to be healthy.

In some lines the orders are far ahead and deliveries are uncertain. Some of the

dealers have felt that orders are coming in too freely and that this points to future cancellations but this attitude is not generally expressed.

The new tools now in demand are needed because of the many changes in the models of cars made within the past few months. These changes have been abrupt in some cases and they have brought about some disturbances in the trade. These are straightening out, however, and the whole machinery and machine tool field here is in very good condition.

Deliveries on some types of specialized equipment are fairly slow. Most of the interest seems to be centered around the Chrysler organization. Little is known about the future plans of the company, but many rumors of expansion are current together with a tie-up with Ford.

General business in Detroit and vicinity is exceedingly good.

NEW YORK

Machine tool sales continue at a high level in the New York market, and predictions are made that the month's business will be equal to, if not greater than September's. Nearly all dealers and factory representatives reported conditions satisfactory. One dealer reported an excellent volume of orders in the past week and stated that he had a tremendous lot of possible business pending. As for the past few months, single orders predominate, with but few exceptions. Among the buyers mentioned were: the International Motor Co., the E. W. Bliss Co., the Watson Machine Co., the Wright Aeronautical Co. (pattern shop machines) the General Electric Co., and the New York Central R.R., the last named purchasing a radial drill and a milling machine, among other equipment. Two dealers reported activity in lathes. The purchase of a number of large planers by R. Hoe & Co. has been delayed for some weeks, and it is understood that additional equipment is to be bought. While the buying on the part of Bliss has been cautious and from only a few selected firms, it is anticipated that in this case also much future business is to be expected by the first of the year.

Aside from the local orders placed by the New York Central R.R., the railroad situation is expected to revive from its lethargy. The Norfolk & Western R.R. has inquired for a large number of machine tools, and other business is looked for in the Chicago district by companies serving the whole country. The sale of large miscellaneous equipment remains sluggish, except for the rebuilt or second-hand machine dealers, but the shops are finding special work to keep them employed. The Niles Tool Works Co. recently received an order for 47 special spot welders from an automotive parts manufacturer in the West.

Other sales by the Niles company included: a 36-in. x 14-ft. Time Saver lathe, three Ransom special grinders, and an Acme double bolt cutter, all to a railroad in the West. The machinery division of the company sold a Long & Allstatter No. A single I-beam punch, a Cincinnati high-speed bench tapper, and an Aurora 20-in. drill. The Pratt & Whitney Co. sold a 7 x 32-in. and a 20 x 120-in. bench lathe, three No. 1A jig borers, two No. 2 jig borers, three deep-hole drillers, one No. 3A universal die sinker, one single-end hand centering machine, and a 4½ x 12-in. thread miller.

The Triplex Machine Tool Co. reports the sale of six Springeld lathes, two Swiss jig borers, an Oesterlein cutter grinder, a Campbell nibbler, two small bench power presses, and two small bench drill presses. The company states that the prospects of activity at the end of the month are bright.

An industrial truck manufacturer reports orders received thus far this month greatly in excess of ordinary figures, with center of sales in the Chicago district, scattered among a diversified number of shops, but with automotive and tractor shops predominant.

Sales of grinding wheels continue at a high level, indicating considerable metal-working activity.

S.A.E. Production Meeting to Be Held at Detroit

Below is published the complete program of the Production Meeting of the Society of Automotive Engineers to be held at the Book Cadillac Hotel, Detroit, Mich., November 22 and 23. The committee which prepared the program consists of E. P. Blanchard, chairman, and J. B. Armitage, A. R. Fors, G. Walker Gilmer, Jr., Guy Hubbard, Erik Oberg and John Younger.

Thursday, November 22

Opening Session, 10 a.m.

E. P. Blanchard, General Chairman

Guy Hubbard, Chairman

REPORT OF SUBCOMMITTEE ON PROCESS AND EQUIPMENT—Chairman G. W. Blackinton.

HOW THE FORD MOTOR COMPANY GETS ITS PHENOMENALLY LOW PRODUCTION COSTS—John Younger, Ohio State University.

PRODUCTION FROM THE ACCOUNTING POINT OF VIEW—L. A. Baron, Comptroller, Stutz Motor Car Co.

REPORT OF SUBCOMMITTEE ON PRODUCTION EXPENSE—Chairman H. P. Harrison.

THE RELATION OF TIME STUDY TO MANUFACTURING—L. W. Haskell, Dodge Brothers, Inc.

REPORT OF TIME STUDY SUBCOMMITTEE—Chairman Eugene Bouton.

Open Luncheon Conference, 12:30 p.m.

John Younger, Chairman

TOPIC: Selection and utilizing of machine tools; the methods by which the factory management is informed as to the necessity for purchasing new tool equipment and the methods of selecting new machines and ultimately making the purchase. Discussion to be led by William Bayes of the White Motor Co.

Afternoon Session, 2 p.m.

P. L. Tenney, Chairman

REPORT OF PRODUCTION STANDARDS SUBCOMMITTEE—Chairman L. F. Maurer.

REPORT OF INSPECTION METHODS SUBCOMMITTEE—Chairman Paul Abbott.

THE BARNES GEAR SHAVER PROCESS—H. D. Tanner, Pratt & Whitney Co.

INTEGRAL CONTACT GEARING—A. B. Cox, consulting engineer.

HONING PROGRESS—C. G. Williams, Barnes Drill Co.

Detroit Section Production Dinner, 8 p.m.

Paper by K. T. Keller, vice-president in charge of manufacturing, the Chrysler Corporation.

Talk by E. P. Blanchard.

Friday, November 23

Material Handling Session, 10 a.m.

V. P. Rumely, Chairman

REPORT OF MATERIAL HANDLING SUBCOMMITTEE—Chairman V. P. Rumely.

ASSEMBLY PLANT LAYOUT FOR MATERIAL HANDLING—N. H. Preble, Mechanical Handling Systems, Inc.

SELECTION OF CONVEYOR POWER UNITS—C. E. Broome, Gears and Forgings, Incorporated.

POSSIBILITIES AND LIMITATIONS OF CONVEYOR CHAIN CURVATURE—J. B. Webb, J. B. Webb Co.

Open Luncheon Conference, 12:30 p.m.

A. R. Fors, Chairman

TOPIC: Maintenance.

Power-Transmission Session, 2 p.m.

G. Walker Gilmer, Chairman

POWER TRANSMISSION ENGINEERING AS AFFECTING PRODUCTION AND COST—W. W. Nichols, D. P. Brown & Co.

Prepared discussion on chain and other types of drive and on actual savings obtained by proper belting by production engineers.

Evening Session, 8 p.m.

REPORT OF PRODUCTION MEETINGS OF THE SOCIETY—Guy Hubbard.

DEVELOPMENT OF PRODUCTION ENGINEERS AND EXECUTIVES—Paul Geyser, General Motors Truck Co.

Ford to Concentrate Tractor Production in Ireland

The principal seat of the manufacture of Fordson tractors by the Ford Motor Co. will be transferred from Fordson, Mich., to Cork, Ireland, by next January, it was learned recently. No tractors are now being produced in the United States, but it is not expected that this work will be permanently abandoned. The principal reason for the transfer, as explained by officials, is that increased demands for tractors in Europe has made increased production overseas advisable.

Approximately 80 per cent of the tractor-making machinery and equipment is being removed to Cork in Ford vessels, the first of which departed several days ago. The cork plant is to be operated on a basis of two 8-hour shifts a day, turning out approximately 300 tractors daily.

Ford officials said the Russian Soviet government recently placed an order for $1,000,000 worth of tractors.

Babbitt Consumption High

The total apparent consumption of babbitt metal in September based on reports received by the Department of Commerce from 31 firms, was 5,308,403 lb. as compared with 4,755,662 in August and 4,792,367 in September, 1927. This consumption is calculated from sales by manufacturers and consumption by those firms (among them several important railroad systems) which consume their own production. The September figure is the highest attained this year.

Plans for Machine Tool Builders' Show Progressing

Plans for the second exposition of the National Machine Tool Builders' Association are well under way even at this early date. The show is to be held in the West Annex of the Cleveland Public Auditorium, September 30 to October 4, 1929. Space in the show is already 80 per cent reserved. To date 130 exhibitors have applied for space: 87 machine tool builders, 42,050 sq.ft.; 35 accessory manufacturers, 7,750 sq.ft.; and 8 business papers, 1,700 sq.ft. From

these figures it is probable that there will not be enough space to take care of all those wishing to exhibit.

Business Items

The Homestead Valve Manufacturing Co. has relocated its plant at Coraopolis, Pennsylvania.

Robbins & Robbins, 1003 Magazine St., New Orleans, La., are now representing the Standard Conveyor Co., of North St. Paul, Minnesota.

The Wallace Machine and Tool Co., of Indianapolis, has filed papers with the secretary of state evidencing the preliminary dissolution of the corporation.

Officials of the A. L. Stone Road Machinery Co., of Connersville, Ind., have filed papers with the secretary of state in Indianapolis evidencing the preliminary dissolution of the corporation.

The Nepperhan Foundry Co., Yonkers, N. Y., has been incorporated with $250,000 capital to manufacture castings, by J. Bowen, attorney, 81 Fulton St., New York City.

Wise & Braisted, General Motors Bldg., Detroit, Mich., have been appointed district sales agents of the Roller-Smith Co., of New York, maker of electrical measuring instruments.

Suit for receivership has been brought against the Phil Easterday Co., Terre Haute, Ind., manufacturer of machinery for making concrete pipe, by the First McKeen National Bank & Trust Co. J. G. Van Winkle has been named receiver.

The R. E. Doane Machinery Co., 538 South Clark St., Chicago, Ill., has taken out letters of incorporation. Business, dealing in machinery of every description. Capital, $25,000. Incorporators: R. E. Doane, Lyon J. Morgan and David Snow.

The National Automatic Tool Co., Richmond, Ind., has acquired a four-story brick building there to be used for warehouse purposes. The company produces multiple drills and is working day and night at the present time.

The Diamond Chain and Manufacturing Co., of Indianapolis, Ind., has completed arrangements with the I. H. Dexter Co., of Goshen, N. Y., for the manufacture and sale of the Clark flexible coupling embodying two sprocket halves around which is wrapper Diamond roller chain.

The Illinois Vorclone Co., 147 West Austin Ave., Chicago, Ill., has been granted letters of incorporation. The company will deal in and repair machinery and machine parts. The capital is 1,000 shares, no par value. Incorporators: J. C. Marshall, J. A. Power and M. J. Power.

Incorporation papers have been taken out by R. E. Nu Parts Corporation, 112 W. Adams St., Chicago, Ill., to manufacture and deal in equipment and devices used in connection with automobiles, trucks, motorcycles, airplanes and engines. Capital, $100,000. Incorporators: H. C. Yost, R. E. Golden and A. G. Ziesk.

The Griffin Foundry & Manufacturing Co., Rome, Ga., has started the rebuilding of one of the main units of the plant destroyed by fire the middle of this month at a loss of about $25,000, partly covered by insurance. The foundry department was almost totally destroyed but only a small part of the machine shop department was damaged.

Letters of incorporation have been issued to the Allied Products Corporation, 112 W. Adams St., Chicago, Ill., to manufacture and deal in articles used in operation or construction of automobiles and other vehicles. Capital 50,000 shares Class A common, no par value. Incorporators: Frederick J. Powell, William A. Bradford and James F. Spoerri.

Exclusive American sales, manufacturing and distribution rights for the Cirrus airplane motor have been purchased by a banking syndicate headed by Campbell, Peterson & Co., Inc., and, according to plans now under way, a plant will be erected in this country to build the motor here. The engine is used extensively throughout the world and holds the light airplane non-stop distance record.

Arrangements have been completed for the merger of the Keystone Aircraft Corporation of Bristol, Pa., with the Loening Aeronautical Engineering Corporation of New York through the exchange of all outstanding shares of the latter corporation for those of the former, according to Richard F. Hoyt, chairman of the Keystone Corporation. The combined corporation will have more than $1,500,000 in cash balances.

The Wayne Co., of Fort Wayne, Ind., manufacturer of gasoline filling station pumps, water softeners, gasoline filters and similar equipment, has bought the Boyle Dayton Co., pump manufacturer of Los Angeles, Calif. The consideration is said to have been $1,000,000. The Wayne Co. has been engaged in an expansion program for some time and the purchase of the California company is another step along this line. For the present the Fort Wayne organization will operate the California plant at its present location.

The possibility of the Wabash railroad erecting shops in Lafayette, Ind., is indicated in the completion of negotiations whereby the railroad company acquires 63 acres of land northeast of Lafayette and adjoining the city's boundary line. A representative of the company, who was in the city to close the deal, would not say to what use the land was to be put other than it was purchased to relieve congestion in the city. It has been rumored along the system for some time that the company contemplated the erection of shops for the Peru-Danville division.

Personals

H. L. CRULL is now assistant sales manager of the Oilgear Co., of Milwaukee.

C. W. RUSSELL, vice-president and general manager of the Russel Wheel & Foundry Co., Detroit, on Oct. 1 resigned.

LEWIS REX MILLER, of New York City, has been appointed Assistant Trade Commissioner at Sydney, New South Wales, Australia.

R. J. WORKING is now district sales manager of the Central Alloy Steel Corporation, of Massillon, Ohio. He succeeds J. O. Dearth, resigned.

H. P. SEELEY, formerly connected with the planning department of the Packard Motor Car Co., is now in a similar capacity with the Kelvinator Corporation, Detroit.

JOHN EDGAR, 1925 Clinton Street, Rockford, Ill., foreman for the Barber-Colman Co., has been granted patents for a dressing attachment for hob grinding machines and a method of dressing grinding wheels.

R. M. PORTER has joined the sales force of the Van Dorn Electric Tool Co., of Cleveland, and will cover the Philadelphia and Camden (N. J.) territory. R. F. Hutt has been placed in charge of the field covered by the Minneapolis office.

O. B. HARRISON, senior member of Harrison & Son, operating a general machine shop business in Peru, Ind., recently celebrated his 80th birthday. He is still active in the business. He has been in the same business there forty years.

P. C. HOUGH, of the service department, Black & Decker Manufacturing Co., will leave shortly for Australia to establish service facilities for the users of Black & Decker products in Australia and New Zealand.

CALVIN R. MCGAHEY has joined the sales engineering force of the Hill Clutch Machine & Foundry Co., of Cleveland, Ohio. He will cover the South, including Virginia, Tennessee, North and South Carolina, Georgia, Alabama, Florida, Mississippi and Lousiana.

GEORGE E. BALDWIN, formerly associated with the Poldi Steel Corporation, has been appointed district sales manager for the Braebury Alloy Steel Corporation in the metropolitan district of New York, having headquarters at 1247 Bryant Park Bldg., New York.

OWEN D. YOUNG, chairman of the Board of the General Electric Co., received the degree of Doctor of Laws from the University of the State of New York on Oct. 18. He was characterized as a "doer of things" and was honored for his devoted services to the interests of education and research in the midst of a busy and distinguished career.

HARRY H. STEIDLE, of Beechwood Park, Pa., has been appointed assistant chief business specialist in the Commercial Standards Unit of the Bureau of Standards, U. S. Department of Commerce. He was formerly associated with the National Committee on Wood Utilization of the Department of Commerce.

ATHERTON CLARK, of the export department, the Black & Decker Manufacturing Co., will start early in November on a year's trip to include Hawaii, Japan, China, Philippine Islands, Malaya, Dutch East Indies, India, Australia and New Zealand, visiting the present distributors of Black & Decker products in these countries, and establishing new distributing connections.

E. J. FROST was made an honorary member of the American Gear Manufacturers' Association at its semi-annual meeting at Buffalo on Oct. 11-13. Mr. Frost was president of the Frost Gear & Forge Co., but sold his interest in the concern recently, and thus became ineligible for regular membership in the association in which he had been active since its formation in 1917. In the year 1927-28, he was president of the association.

Obituaries

MORRIS B. DEAN, vice-president of the Schramm Manufacturing Co., of Philadelphia, manufacturer of airplane engines, died recently.

FRANK GIFFORD DREW, , chairman of the board of the Winchester Repeating Arms Co., New Haven, Conn., died on Oct. 20 as a result of injuries received in an automobile accident which occured as he was driving to New Haven from the convention of the Hardware Manufacturers and Jobbers Association, held at Atlantic City. Mr. Drew a native of Philadelphia, was 55 years old. He was engaged in the wholesale hardware business in Philadelphia from 1887 to 1903, when he became a salesman with the Winchester Repeating Arms Co. In 1924 he was elected president of the company and in 1927 chairman of the board. He was vice-president of the Winchester-Simmons Co. and the Simmons Hardware Company.

Forthcoming Meetings

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

Iron and Steel Division, American Society of Mechanical Engineers. Second national meeting, Chicago, November 14-15. Thomas Wilson, chairman of Chicago local section, host, 7 S. Dearborn St., Chicago.

Society of Automotive Engineers. Production meeting, Book-Cadillac Hotel, Detroit, Mich., Nov. 22-23. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Seventh National Exposition of Power and Mechanical Engineering. Held at Grand Central Palace, New York, N. Y., week of December 3.

Power Transmission Association. Annual meeting, Hotel Commodore, New York City, Dec. 6. Association headquarters, 644 Drexel Bldg., Philadelphia.

The Weekly Price Guide

Rise and Fall of the Market

AN upward movement in prices characterizes the basic materials used in metal-working industries. Furnace coke, pig iron, scrap and finished steel, for example, are advancing together. The price trend in structural shapes offers a good illustration of the present direction of the steel market. Shapes were $1.80 per 100 lb., f.o.b., Pittsburgh, in large mill lots, Jan. 1, 1928. On Feb. 1, the price went to $1.85 and remained at that level for eight consecutive months until Oct. 1, at which time the present quotation of $1.90 went into effect. The net change in ten months has been 10c. per 100 lb. or $2 per ton. Among the non-ferrous materials, solder, babbitt metal (highest grade), scrap brass and lead, declined; linseed oil is up 0.5c. per lb.

(All prices as of Oct. 19, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.12
BIRMINGHAM	
No. 2 Foundry	16.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.26
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.51
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.60@2.70	3.60	3.30	4.00
No. 22	2.75@2.85	3.75	3.45	4.15
No. 24	2.80@2.90	3.80	3.50	4.20
No. 26	2.90@3.00	3.90	3.60	4.30
No. 28	3.05@3.15	4.05	3.75	4.45
Galvanized				
No. 10	2.70@2.80	3.95	3.65	4.25
Nos. 12 to 14	2.80@2.90	4.05	3.75	4.35
No. 16	2.90@3.00	4.15	3.85	4.45
No. 18	3.05@3.15	4.30	4.00	4.60
No. 20	3.20@3.30	4.45	4.20	4.75
No. 22	3.25@3.35	4.50	4.25	4.80
No. 24	3.50@3.60	4.65	4.35	4.95
No. 26	3.65@3.75	4.90	4.60	5.20
No. 28	3.90@4.00	5.15	4.85	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	Thickness—B.w.g. and Fractions	Outside Diameter in Inches—⅛	¼	⅜	½	¾	1	1⅛	1¼
		Price per Foot							
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23	
.049"	18	.17	.18	.19	.20	.21	.23	.25	
.065"	16	.19	.20	.21	.22	.23	.25	.27	
.083"	14	.20	.22	.23	.24	.25	.27	.29	
.095"	13	.21	.23	.25	.26	.27	.29	.31	
.109"	12	.22	.24	.26	.27	.28	.30	.32	
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33	
.134"	10	.24	.26	.28	.29	.30	.32	.34	

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, ⅛@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.00
Tin, Straits, pigs, New York			52.00
Lead, pigs, E. St. Louis	6.32½	New York	8.00
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.75	14.75	14.25
Copper sheets, base	24.00	24.00	24.00
Copper wire, base	20.62½	20.62½	17.25*
Copper bars, base	22.50	22.50	23.00
Copper tubing, base	25.50	25.50	25.50
Brass sheets, high, base	19.75	19.75	19.75
Brass tubing, high, base	24.62½	24.62½	24.62½
Brass rods, high, base	17.50	17.50	17.50
Brass wire, high, base	20.25	20.25	20.25

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	10.01
Solder (½ and ½).....	34.25	33.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade.....			68.25
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots..... 35.00	Electrolytic.. 37.00	Shot.....	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled nickel rods, Grade "A" (base).....	45.00
Cold drawn nickel rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	13.37½@13.50	13.25	12.25@12.75
Copper, heavy, and wire..	12.62½@13.37½	12.75	11.62½@12.00
Copper, light, and bottoms	11.37½@11.62½	10.75	10.50@11.00
Heavy lead.....	5.25 @ 5.37½	6.25	4.75@ 5.25
Tea lead.....	3.50 @ 4.00	4.25	3.75@ 4.25
Brass, heavy, yellow.....	7.37½@ 7.62½	8.25	7.50@ 8.00
Brass, heavy, red.....	10.00 @10.50	11.25	10.00@10.50
Brass, light.....	6.00 @ 6.50	6.75	6.50@ 7.00
No. 1 yellow rod turnings.	8.50 @ 8.75	8.25	8.00@ 8.50
Zinc.....	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.16@16¼	38.00 per M	.17
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.112	.11	.11
Cutting oil, about 25% lard, in 5 gal. cans, per gal....	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft per inch of width for single ply.:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt.	30–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb.....	$0.0325	$0.0325	$0.0324
Cold drawn shafting....	per lb.....	.034	.034	.04
Brass rods.....	per lb.....	.175	.1725	.16
Solder (½ and ½).....	per lb.....	.3425	.34	.3625
Cotton waste, white....	per lb.....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.05	3.05	3.10
Lard cutting oil.....	per gal...	.65	.65	.65
Machine oil.....	per gal...	.30	.30	.27
Belting, leather, medium.....	off list....	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.05*	$4.29	$4.29
Emery cloth.....	20.22†	20.97	20.97
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	2.04‡	1.32	1.32
Cloth.....	3.59‡	3.05	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@3.00
Coke, prompt foundry, per net ton...	Connellsville,		4.00@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.25
Red lead, dry.....	100 lb. kegs....	New York,	13.25
Red lead, in oil.....	100 lb. kegs....	New York,	14.75

*5 reams or more. †2 reams or more. ‡Aluminum oxide mineral.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1⅛ and 1¼ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including 7/16-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Calif., San Diego—Bureau of Yards & Docks, Navy Dept., Washington, D. C.—will readvertise for bids soon for an electric bridge crane for Air Station here. Former bids rejected.

Mich., Detroit—Briggs Mfg. Co., 11631 Mack Ave.—crane and conveyor system, etc. for proposed 2 story, 575 x 700 ft. auto body plant on East Warren Ave.

Mich., Flint—Crane Co., 836 South Michigan Ave., Chicago, Ill.—mono rail carrier system, crane, etc. for proposed 1 story, 105 x 105 ft. pipe warehouse here. Estimated cost $50,000.

Mich., Jackson—Frost Gear & Forge Co.—forge shop equipment for proposed 1 and 2 story, 100 x 160 and 50 x 100 ft. factory on South Horton St. Estimated cost $75,000.

Mich., Saginaw — Wilcox Products Div. Wilcox-Rich Corp. (auto parts)—general machine shop equipment for proposed 1 story, 30 x 270 ft. factory. Estimated cost $50,000.

Mo., St. Louis—Bd. of Public Service—will receive bids until Nov. 20, for 10 ton electric box, girder, crane and hoist for Fire Dept. repair shops in municipal service building. $11,000.

N. Y., New York—P. J. Dooling, Comr. of Purchases, Municipal Bldg.—will receive bids until Oct. 30 for lathe for Dept. of Plant and Structures.

O., Cleveland—W. J. Buckwalter (Service Mgr. for North Ohio Motor Co.,5005 Euclid Ave.) bench lathe, 2½ or 3 ft. bed with Collett chuck attachment and compound slide rest.

Ont., Chippawa—Norton Co. of Canada, N. Wilson, Mgr.—equipment for the manufacture of grinding wheels and abrasives for proposed 1 story, 5 x 150 ft. addition to factory. Estimated cost $50,000.

Ont., Hamilton — Wallace Barnes Co., Serhman & Biggar Sts.—machinery and equipment for the manufacture of springs and wire products for proposed 2 story, 65 x 125 ft. addition to factory. Estimated cost $50,000.

Ont., Hamilton—Wettlaufer Foundry Co., Mitchell, R. Stroud, Mgr.—machinery and equipment for recently acquired plant here.

Ont., Windsor—Wood Hydraulic Hoist & Body Co., 1025 Tecumseh Rd., P. Wood, Mgr.—equipment for the manufacture of steel truck bodies and truck hoisting equipment for proposed 1 story, 100 x 125 ft. addition to factory. Estimated cost $60,000.

Opportunities for Future Business

Ala., Birmingham—Gulf States Steel Co., B. M. Bldg., plans to expend $3,000,000 for extensions and improvements to plant.

Calif., Culver City—J. Kruetzer, 1801 South Hope St., Los Angeles, is having plans prepared for the construction of an airport including hangars, administration building, shops, etc. here. Estimated cost $300,000. Austin Co. of California, 77 East Washington St., Los Angeles, Archt.

Calif., Eureka—Highway Commission, Sacramento, is having preliminary plans prepared for the construction of maintenance shops, etc. here. Estimated cost $83,000. G. B. McDougal, Sacramento, State Archt.

Calif., San Diego—Gildred Bros., awarded contract for a 2 and 4 story, garage at A, B, 7th and 8th St. Estimated cost $1,000,000.

Fla., Jacksonville—City Comn., plans an ordinance authorizing the construction of a machine shop and garage on Block A, Springfield.

Ill., East St. Louis — Evans-Wallower Lead Co., has work under way on the construction of a plant for the production of electrolytic zinc including shops, etc., here.

Ill., East St. Louis—Parks Airlines, Inc., Missouri Theatre Bldg., St. Louis, Mo., awarded contract for a 1 story, 100 x 560 ft. airplane factory, here. Estimated cost $200,000. Noted July 26.

Ill., Rockford—Rockford Die & Tool Co., 727 7th St., has work under way on the construction of a factory on 7th Ave. between 13th and 14th Sts. Estimated cost $10,000.

Ind., Crawfordsville—Mid-States Steel Co., awarded contract for a 1 story, 85 x 250 ft. factory. Estimated cost $50,000.

Ind., South Bend—Studebaker Corp., awarded contract for a 1 story, 62 x 302 ft. factory at Sample St. Estimated cost $75,000.

Ia., Cedar Rapids—Hudson-Essex Motor Co., 527 Second Ave. E., awarded contract for the construction of a 1 story, 60 x 150 ft. garage at Second Ave. and 8th St. E. C. B. Zalesky, Security Bldg., Archt.

Ia., Council Bluffs—C. N. Tompkins, will build a 1 story, 50 x 125 ft. garage at Third St. and Lexington Ave. Estimated cost $30,000.

Ia., Sioux City—The Albertson Co., manufacturers of automotive tools, awarded contract for a 4 story, 40 x 150 ft. addition to factory. Estimated cost $42,000. Noted Oct. 11.

Md., Baltimore—Crown Cork & Seal Co. Inc., 1511 Guilford Ave., plans a 150 x 600 ft. addition to plant.

Mass., Brockton—Brockton Gas Light Co., G. H. Priest, Mgr., 54 Main St., awarded contract for a 1 story, 125 x 125 ft. garage and repair shop on School St. Estimated cost $50,000.

Mass., Haverhill—Smith Motor Car Co., 88 South Main St., is receiving bids for a 1 story, 100 x 135 ft., repair and service garage at 74-84 South Main St. Estimated cost $45,000. Noted Oct. 4.

Mass., Springfield—The Main & Cypress Realty Co., c/o J. W. Foster, 105 Bridge St., awarded contract for a 2 story, 60 x 150 ft. repair and service garage at Main and Cypress Sts. Estimater cost $50,000.

Mich., Detroit — Dodge Bros., Div. Chrysler Motor Corp., 341 Massachusetts Ave., Highland Park, awarded contract for a 1 story, 120 x 1,950 ft. automobile factory on Mt. Elliott Ave.

Mich., Detroit — Michigan Steel Tube Products Co., plans extensions and additions to plant. Estimated cost $300,000.

Mich., Lansing—Motor Wheel Corp., Ferris and Larch Sts., is receiving bids for a 1 story, 200 x 400 and 100 x 400 ft. motor parts factory on Ferris St. Private plans.

Minn., Faribault—F. R. Kummer awarded contract for a 1 story, 66 x 170 ft. garage. L. C. Pinault, St. Mary's Bldg., St. Cloud, archt. Ntoed Aug. 30.

Mont., Great Falls — C. R. Lowery awarded contract for a 1 story, 100 x 150 ft. garage at Central Ave. and 8th St., Shanley & Baker, archts.

Mo., St. Louis—N. C. Nelson Mfg. Co., 928 Chestnut St., manufacturers of plumbing supplies, etc., will build a 2 story, 150 x 257 ft. factory and warehouse, etc. at 3406 Duncan Ave. Estimated cost $300,000. P. J. Bradshaw, 718 Locust St., Archt. Noted Sept. 13.

Neb., Albion—Burt Watson will build a 1 story, 65 x 92 ft. garage at Church St. and Fifth Ave. Paramount Motor Co., lessee.

New Jersey—Constructing Quartermaster, Picatinny Arsenal, will receive bids until Nov. 7 for administration building, thirteen buildings for laboratory area, twenty-one buildings in melt loading area and three buildings in shop area.

N. J., Jersey City—R. G. Maupai Co., 73 South St., plans the construction of a 2 story machine shop, etc. at 164-166 Central Ave. Estimated cost $50,000. Architect not announced.

N. J., Jersey City—C. Mundt & Sons, 53 Fairmont Ave., awarded contract for a 2 story, 35 x 132 ft. addition to machine shop at 51-67 Fairmont Ave. Estimated cost $40,000.

N. J., Trenton—De Laevo Steam Boiler Co. awarded contract for 1 story, 70 x 215 ft. assembly building and 1 story, 40 x 65 ft. shipping building. Estimated cost $150,000.

N. Y., Brooklyn—Improved Cinder Co., M. M. Upton, Pres., 90 West St., New York, is receiving bids for the construction of a metal reducing plant at Van Dam St. and Newtown Creek. Estimated cost $50,000. Klemert & Klie, 250 Park Ave., New York, Archts. Noted Oct. 4.

N. Y., Brooklyn — Steel & Tubes Inc., Scott Ave. and Maserole Ext., will soon award contract for the construction of a factory at Scott Ave. and Montrose Ext. Estimated cost $40,000. Austin Co., 120 Broadway, New York, Archt. Noted Sept. 27.

N. Y., East Buffalo (Buffalo P. O.) — New York Central R.R., 466 Lexington Ave., New York, will soon receive bids for the construction of car repair shops here. F. B. Freeman, Ch. Engr.

N. Y., New York — Arnold Construction Corp., A. B. Basheim, Pres., 289 Mott Ave., will build a 1 story, 107 x 112 ft. garage at Mott Ave. and 140th St. Estimated cost $60,000. Moore & Lansiedel, 148th St. and 3rd Ave., Archts. Noted Aug. 16.

N. Y., New York—Koenig-Leiser Realty Corp., N. Koenig, Pres., 391 East 149th St., plans the construction of a 2 story, 93 x 100 ft. garage at Mayflower and Wilkinson Sts. Estimated cost $98,000. Cohn & Siegel, 45 West 57th St., Archts.

N. Y., New York—Phillip Weeks Estate, 225 West 106th St., plans the construction of a 4 story, 40 x 75 ft. garage at 136 East 41st St. Estimated cost $40,000.

N. D., Sherwood—C. Owen, will build a 1 story, 24 x 80 ft. repair and service garage.

O., Cleveland—Interior Finish & Millwork Co., 9517 Meech Ave., plans the construction of a 1 story, 30 x 100 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Shaker Garage Co., c/o C. J. Herbold, Terminal Tower Bldg., is having plans prepared for the construction of a 1 story garage on Shaker Blvd. Estimated cost $200,000. Small & Rowley, Terminal Tower Bldg., Archts.

Pa., Philadelphia—A. Atwater Kent, Wissahicken Ave. and Abbottsford Row, plans the construction of a 515 x 911 ft. factory for the manufacturer of radios. Ballinger Co., 12th and Chestnut Sts., is architect.

Tex., Wichita Falls — American Battery Products Corp., c/o C. V. Chermendy, plans the construction of a plant. Estimated cost $60,000.

Wash., Seattle—C. O. Radford, National Bank of Commerce Bldg., awarded contract for a 2 story, 24 x 120 ft. garage and auto sales building. Estimated cost $150,000.

Wis., Manitowoc—Aluminum Goods Mfg. Co., H. L. Vits, Gen. Mgr., awarded contract for the construction of a 7 story, 115 x 302 ft. addition to factory. Estimated cost $600,000.

Man., Winnipeg—Canadian Pacific Ry. Co., Montreal, Que., awarded contract for a 305 x 317 ft. addition to car shops here. Estimated cost $400,000. J. M. R. Fairbairn, Ch. Engr.

Ont., Ottawa—Dept. of Public Works, is receiving bids for the construction of a pyro-metallurgical laboratory on Booth St. Estimated cost $20,000. T. W. Fuller, Archt.

Ont., Toronto—Dominion Radiator & Boiler Co., 1322 Dufferin St., plans the construction of a plant at Dufferin St. Estimated cost $300,000. Architect and engineer not selected.

Que., Montreal—Fairchild Aviation Ltd. E. Wilson, Pres., plans the construction of an aeroplane factory. Estimated cost $250,000.